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DEPARTMENT OF THE ARMY FIELD MANUAL

THE FIELD ARTILLERY SEARCHLIGHT BATTERY



HEADQUARTERS, DEPARTMENT OF THE ARMY
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THE FIELD ARTILLERY SEARCHLIGHT BATTERY

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CHAPTER 1

GENERAL

1. Mission, Purpose, and Scope

a. The mission of the field artillery searchlight battery is to furnish direct or indirect illumination in support of tactical night operations within division and corps areas.

b. This manual is a guide for the commander and personnel of the field artillery searchlight battery. It will assist the commander in developing the battery into an efficient, smooth-working unit capable of operating effectively in combat. The manual covers organization, command, and tactical control. It includes information about unit capabilities and limitations, battlefield illumination, and control and direction of illumination necessary for commanders and staffs at all echelons employing the field artillery searchlight. The material presented herein is applicable without modification to nuclear and conventional warfare, and to counterinsurgency.

2. Changes or Comments

a. Users of this manual are encouraged to submit recommended changes or comments to improve the publication. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comments should be

forwarded direct to Commanding Officer, United States Army Combat Developments Command Artillery Agency, ATTN: CAGAT-DO, Fort Sill, Oklahoma, 73504.

b. Changes involving safety of personnel should be transmitted by electrical means.

3. Terms and Definitions

a. *Action complete.* Report of compliance with the last correction or command.

b. *Flick.* Command to turn on the searchlight; corresponds to the command FIRE.

c. *Hold.* Command to keep the searchlight on the same azimuth, elevation, and beam spread; corresponds to the command REPEAT RANGE.

d. *Cut.* Command to turn off the searchlight; corresponds to the command CEASE FIRE.

e. *Spread (reduce) beam.* Command to increase (decrease) the width of the searchlight beam.

f. *Focused beam.* Optimum beam focus (52 mils wide).

g. *Hold-cut.* Command used when the forward observer wants the lights off but laid in the same direction.

h. *Light direction center (LDC).* The element of a searchlight platoon consisting of light direction personnel and equipment, by means of which light direction and control are exercised.



CHAPTER 2

COMMAND, CONTROL, AND ORGANIZATION

Section I. GENERAL

4. Command and Control

The field artillery searchlight battery is assigned to corps artillery. The searchlight battery commander is the searchlight adviser to the corps artillery commander, who, in turn, advises the corps commander in the use of searchlights, units to be supported, areas to be covered, times of employment, and other matters pertaining to the illumination plan.

5. Capabilities and Limitations of Employment

a. The capabilities of the searchlight battery include but are not limited to the following:

- (1) The battery can provide mobile battlefield illumination within the zone of action of one corps under normal conditions.
- (2) Each platoon is capable of providing mobile battlefield illumination within the zone of action of one division under normal conditions.
- (3) The battery can provide sufficient communications for control of organic searchlights.
- (4) The battery is capable of providing organizational maintenance for organic equipment.
- (5) The battery is 100 percent mobile, is air transportable (Phase I), and is helicopter transportable.
- (6) Platoons and sections can operate independently for limited periods of time. When employed in this manner, the platoon or section may require augmentation from the battery communication section.

b. The searchlight battery has certain limitations ((1) through (5) below) which should be considered in its employment.

- (1) The battery has no survey capability. When the battery is operating in general support of a corps, survey must be pro-

vided by the corps artillery. When the battery is operating with platoons in direct support of divisions, survey must be provided the platoon by the supported division artillery.

- (2) The battery communication capability is limited to providing organic internal communications. When the battery is operating in general support of a corps, additional communication personnel and equipment must be provided by corps artillery for initial laying and maintenance of wire lines. When the platoon is augmented with a wire team from the battery communication section, it has a limited wire-laying and maintenance capability. Any additional support required must be provided by the supported unit. Maximum use is made of existing circuits and radio nets for long-range communications.
- (3) The platoons of the battery may be dispersed over a corps zone of action beyond the reach of the battery Class I support and resupply facilities. The sections of each platoon so dispersed should be satellited on the nearest unit or units for such support.
- (4) The supply and maintenance facilities of the battery are limited. Platoons assigned a direct support mission must be provided logistical support, to include resupply of POL (petroleum, oil, and lubricants), and assistance in organizational maintenance of equipment by the supported unit(s). When the battery is assigned the mission of general support of the corps, platoons may be attached to the nearest artillery unit for logistical support.
- (5) The battery has no unit-level medical capability and must be provided such support.

Section II. TACTICAL MISSIONS

6. General

The searchlight battery may be assigned the standard tactical mission of general support or direct support. Also, each of the three platoons may be assigned a separate tactical mission. The battery may be attached in its entirety, by platoon, or by individual searchlight section to another unit for a battlefield, rear area or counterinsurgency operations illumination mission. The responsibilities inherent in each of these standard missions are tabulated in figure 1.

7. General Support

A searchlight battery normally is assigned the mission of general support and provides illumination in support of the corps. Batteries assigned a general support mission are controlled by the corps artillery commander through his fire direction center.

8. Direct Support

A searchlight platoon can be assigned the mission

of direct support to provide illuminating support to a designated unit. Normally, each of the platoons will be assigned a mission of direct support of a division, in which case the division artillery commander, through his fire direction center, exercises operational control over the searchlight platoon.

9. Modified Missions

a. Searchlight units may be assigned standard missions, modified or amplified by appropriate instructions. Such modified missions may pertain to task force or separate operations. When a standard tactical mission is modified, unit capabilities should not be degraded. Searchlight units normally are assigned only general support or direct support missions.

b. In counterinsurgency operations, searchlight sections may operate for extended periods of time separately from the battery, in direct support of units smaller than corps and division, such as brigades or security forces of logistical complexes and small defended areas.

	<i>Direct support</i>	<i>General support</i>
Answers calls for illumination from—	Supported unit.	Supported unit or higher artillery headquarters.
Establishes liaison with—	Supported unit. (Command liaison).	No inherent requirement.
Establishes communication with—	Supported unit. (Artillery headquarters exercising operational control will assist when necessary.)	No inherent requirement. (Internal communications only.)
Has as its zone of operation—	Zone of action of supported unit.	Zone of action of supported unit.
Furnishes forward observers—	No requirement. (Use forward observers from direct support artillery battalion w/maneuver element control.)	No requirement.
Displaces when—	Deemed necessary, after approval of Artillery headquarters exercising operational control.	Ordered by force headquarters, or by higher artillery headquarters.
Has its searchlight plan prepared by—	Develops own plan to support and complement the supported unit fire plan.	Supported unit or higher artillery headquarters.

Figure 1. Field artillery searchlight battery tactical missions.
(Inherent responsibilities)

Section III. ORGANIZATION

10. General

The battery consists of the personnel and equipment necessary to accomplish the illumination mission, movement, administrative functions, and, to a limited extent, the communication, supply, maintenance, and mess functions.

11. Battery Organization

a. The organization of the searchlight battery (fig. 2) is similar to that of a cannon battery. The searchlight battery consists of—

- (1) A battery headquarters.
- (2) A communication section.
- (3) Three searchlight platoons; each consisting of a platoon headquarters and six searchlight sections.

b. The battery headquarters consists of the personnel and equipment necessary to perform administrative, supply, mess, and motor maintenance functions for the battery when operating as an integral unit.

c. The communications section consists of the personnel and equipment necessary to perform the required battery radio and wire functions and limited battery level maintenance of communications equipment.

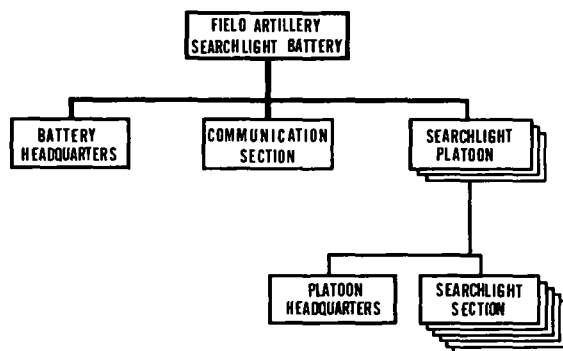


Figure 2. Organization of the searchlight battery.

d. Each searchlight platoon consists of the platoon headquarters and six searchlight sections. Each platoon has the personnel and equipment necessary to operate a light direction center (LDC) and to perform searchlight illumination.

e. Each searchlight section consists of a chief of section, two searchlight crewmen, and a searchlight power generator operator; a 30-inch searchlight, trailer-mounted; an engine-generator, trailer-mounted; and a $\frac{1}{4}$ -ton truck and a $\frac{3}{4}$ -ton truck (prime mover) for the searchlight and engine generator respectively. Duties of the searchlight section personnel are given in appendix III.



CHAPTER 3

RECONNAISSANCE, SELECTION, AND OCCUPATION OF POSITION (RSOP)

Section I. GENERAL

12. Purpose

The purpose of reconnaissance, selection, and occupation of position (RSOP) is to move a unit from a previous illuminating position, from a rendezvous, or bivouac area, or from the march into a position from which it can provide the illumination required to accomplish its mission. A battery is said to be in position when its platoons and searchlights are ready to illuminate.

13. Tasks Involved

Placing the battery headquarters and platoons into position involves—

a. Reconnaissance, selection, and occupation of the position area. Platoons with a direct support mission will accomplish RSOP independently of the battery headquarters.

b. The formulation of a plan for occupying the area selected, to include positions for searchlights,

access routes to searchlight positions, and wire routes.

c. The issuance of orders to carry out the plan.

d. The execution of the order (the actual emplacement of the various elements).

14. Reconnaissance

The tactical employment of searchlights normally should permit daylight reconnaissance, selection, and preparation of the searchlight positions and the battery command post area. The procedures prescribed in FM 6-140 regarding RSOP by cannon batteries generally apply to movement by the battery headquarters and the searchlight platoons. During low-intensity combat, increased security procedures by ground reconnaissance parties, especially in Phase II and III insurgency operational environments, are required for protection from insurgent ambush or other attack. For a detailed discussion of artillery reconnaissance, see FM 6-140.

Section II. SELECTION OF POSITIONS

15. General

Normally, the mission of the battery requires deployment over a corps front; therefore, the selection of a position for each battery element is discussed separately. Seldom will all elements of the battery be concentrated into a single battery area.

16. Basic Considerations

The positions of the battery elements should be easily accessible and should have separate routes for entrance and exit. When a position is to be occupied during daylight hours, special attention must be given to dispersion and camouflage. Whenever possible, separate day and night positions should be selected for each element of the battery, especially for the searchlight section. Local security is a basic consideration especially in counterinsurgency operations.

17. Battery Command Post Area

The battery command post normally is located adjacent to the corps artillery headquarters or, in counterinsurgency operations, with the major supported headquarters to facilitate liaison and planning of support operations. In a general support role, the battery receives its missions from the corps artillery fire direction center. The battery commander, as searchlight adviser to the corps artillery commander, must maintain continuous personal or representative liaison with the corps artillery headquarters.

18. Platoon Headquarters

The platoon headquarters is located where it can best direct the operations of its searchlights. In a direct support role, the platoon headquarters is located in proximity to the supported artillery

headquarters and receives its missions from that fire direction center. The light direction center should be adjacent to the supported unit's artillery fire direction center.

19. Searchlight Positions for Direct Illumination

a. General. When searchlights are used for direct illumination, positions must be selected to enable line-of-sight coverage of the target area. When possible, positions should be outside the range of enemy small arms or mortars and outside the effective range of direct fire weapons. Multiple coverage of the same target or area is desirable; positions should be selected that insure direct illumination from more than one searchlight on each target or area. Positions should also be selected in width and depth to permit delivery of light from different areas at staggered time intervals so that continuous illumination of a single target is possible while some degree of security is afforded the searchlights.

b. Reconnaissance. A detailed map reconnaissance is always made before attempting to select a direct illumination position. A map profile should

be drawn to insure that a given searchlight position permits line of sight to the target area. After the map reconnaissance is made, a ground reconnaissance is conducted to determine access routes and the suitability of the position. Since the position may be occupied in dusk or darkness, provision should be made for route marking. An area which will provide cover and concealment and facilitate supply and maintenance activities should be selected in the vicinity of the searchlight position for occupancy during daylight or other nonoperating periods.

c. Selection of Positions. Searchlight positions selected for direct illumination should be on high ground to afford maximum range and flexibility and to avoid silhouetting friendly troops located along or near the axis of the beam. Defilade from flank observation is desirable since it will deny the enemy bilateral observation (fig. 3).

d. Occupation of Position. Since direct illumination is accomplished from exposed positions, occupation and withdrawal should be accomplished under the cover of darkness. Equipment and personnel occupying these positions should be limited to the minimum requirements for operating the searchlights.

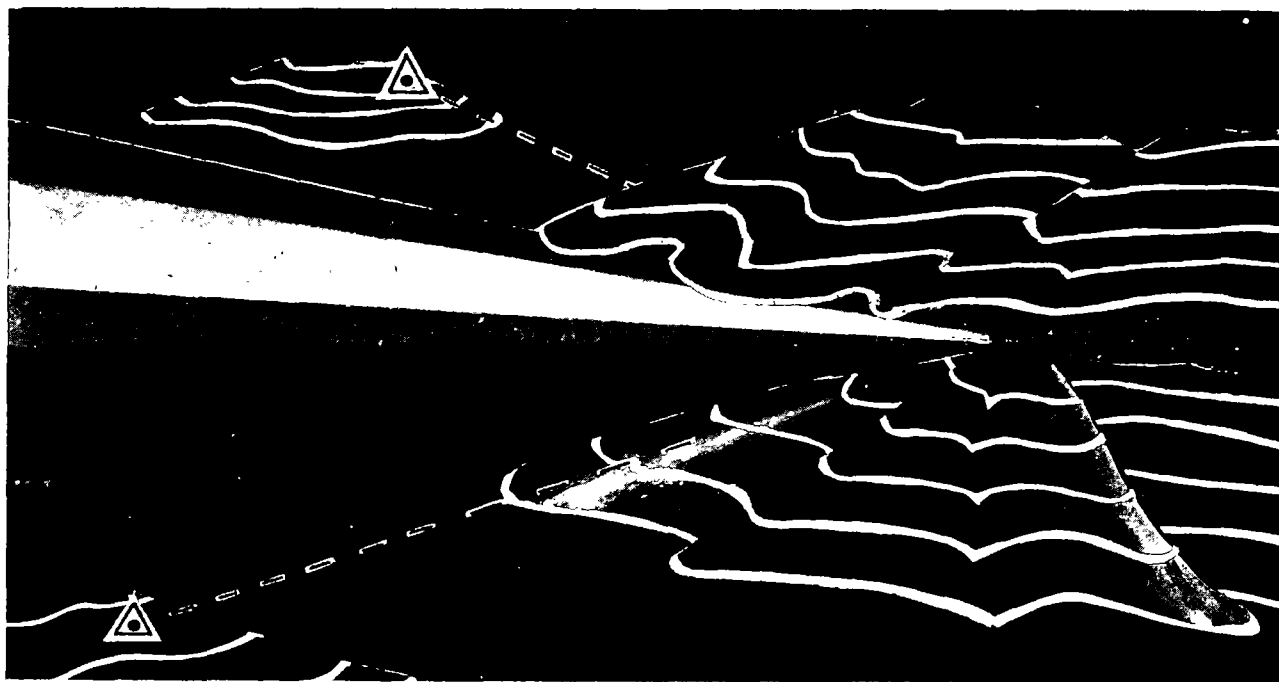


Figure 3. Position denying bilateral observation.

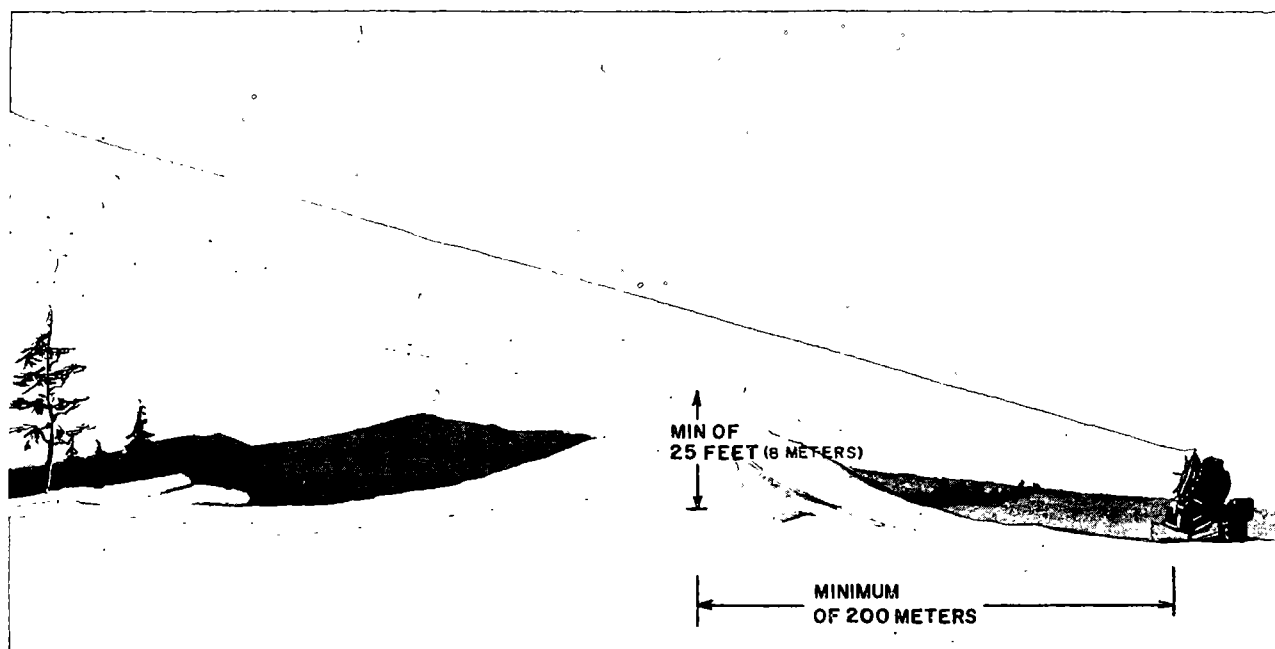


Figure 4. Position for indirect illumination.

20. Searchlight Positions for Indirect Illumination

When searchlights are used for indirect illumination, the searchlight positions are selected to provide a minimum mask of 8 meters for each 200 meters distance from the searchlight to the mask (fig. 4). The least searchlight elevation will provide the most effective ground illumination. However, the use of deep defilade and maximum searchlight-to-mask distances will considerably reduce the enemy's capability to deliver accurate artillery fire on the searchlight position (unless the position is located by an air observer). Open areas are highly desirable

for searchlight positions for indirect illumination because trees, brush, or other close objects may obscure portions of the searchlight beam and necessitate the use of higher elevations. Very high searchlight beam elevations assist the enemy in accurately determining the location of the searchlight position by intersection methods. Searchlight positions normally are selected from 3,000 to 8,000 meters behind the forward edge of the battle area (FEBA) or area to be illuminated and are spaced laterally at intervals as dictated by the terrain, disposition of friendly forces, target area, and desired intensity of illumination.

Section III. OCCUPATION OF POSITION

21. General

A standing operating procedure (SOP) is necessary to assure a rapid and orderly occupation of position. The SOP is prescribed by the battery commander, based on the principles set forth in paragraphs 22 through 25.

22. Procedure in Occupation of Position

a. Guides. Reconnaissance party personnel are designated as guides to meet the elements of the battery as they arrive at the position area. Each

guide is responsible for guiding one of the battery elements to its selected location. During a night operation, each vehicle is met by a guide at the entrance to the position area and directed to its proper location.

b. Movement Into Positions. Movements in the vicinity of the position should be made at reduced speed. Care must be exercised in occupying a position to avoid areas not cleared of mines and to avoid making new tracks that will reveal the position to air observers. Only the necessary vehicles are

brought into the command post area, and those that are not needed for operation are quickly unloaded and dispersed.

c. Night Occupation. When possible, a daylight reconnaissance should be made prior to occupying a position under cover of darkness. Continuous practice in night occupation of position is necessary. All personnel must be thoroughly briefed on the route of march, and route markers must be provided. A night occupation will be slower than a daylight occupation, but it must be just as orderly and efficient. Noise and use of lights must be kept to an absolute minimum.

d. Placement of Equipment. Rapid displacement and night movements make it imperative that each battery element work out an efficient system of loading and unloading equipment. The chief of section supervises the loading of equipment and sees that all equipment is in its proper place before he reports his section in order. Only those items required are unloaded at the position.

23. Sequence of Occupation

Those installations which are immediately necessary for the accomplishment of the assigned mission must be established first.

a. Battery Command Post Area. The installation of the elements with the minimum communication network necessary for operation is the first priority task. Other battery headquarters installations are established as directed by the battery commander.

b. Platoon Headquarters Area. In the platoon headquarters area, the LDC along with its communication network has first priority.

c. Searchlight Position Areas. Dug-in positions for searchlights are prepared before occupation whenever possible. Preparation of searchlight positions prior to occupation facilitates an orderly and efficient occupation.

24. Communication and Survey

a. Communication. Radio contact is maintained during the march unless radio silence or listening silence has been directed. When advance notice of a mission or a move is received in sufficient time, installation of necessary wire lines is completed prior to occupation of position; otherwise, the installation of wire lines begins when the battery (platoon or section) reaches its position.

b. Survey. The grid reference of each searchlight position is plotted on the light direction chart. When accurate maps are available, map inspection will provide a sufficiently accurate location for light direction purposes pending completion of survey. When advance notice of a mission or move is received in sufficient time, the battery should request the supported unit to establish survey control prior to occupation of position.

25. Reports

Upon occupation of position, each searchlight chief of section will report to his platoon light direction center. His report will include—

a. The map coordinates of his position. This can be determined by inspection; by intersection using his compass and map; or by survey if available.

b. The minimum elevation(s) to clear any mask across the entire sector assigned to the searchlight section.

c. The azimuth on which the searchlight is laid. The searchlight may be laid as follows—

(1) *By compass.* Measure an azimuth to a distant aiming point; mark the position of measurement; move the searchlight over the marked point; level the light, and lay on the distant aiming point; set the announced azimuth on the sliding azimuth scale and move it opposite the azimuth index. Select an azimuth in the general direction of anticipated searchlight action and traverse light to that azimuth; a stake may then be set in line for reference purposes only.

(2) *By aiming circle.* Lay aiming circle on grid north; refer to searchlight sight and read azimuth; level the light and lay on the aiming circle; compute the back azimuth from aiming circle to light; set that azimuth on the sliding azimuth scale and move it opposite to the azimuth index; select an azimuth in the general direction of anticipated action and traverse light to that azimuth. A stake may then be set in line for reference purposes only.

d. A statement that the searchlight section is ready for action.

CHAPTER 4

ORGANIZATION OF POSITION

26. General

Organization of position consists of the operations necessary to permit the unit to accomplish its mission. Organization begins when the position area is selected, and development and improvement of the position continues as time permits until the area is vacated.

27. Communication

When the establishment of the battery communication network is not initiated prior to occupation of position, it is begun immediately upon occupation of position. The principles set forth in chapter 5 are followed in the development of the battery communication system.

28. Survey

The location of each searchlight position must be established on the appropriate light direction chart. As a temporary expedient when accurate maps are available, the searchlight positions may be located by inspection, intersection, or resection. These positions are surveyed as soon as possible and the locations are replotted on the light direction chart. Personnel and equipment to perform the necessary survey are provided by either the corps or the supported unit. Survey should be completed prior to occupation of position when possible.

29. Security

a. Headquarters Elements. The battery and platoon headquarters are dependent upon the security organization of the supported unit. The searchlight battery headquarters security measures are integrated into the corps artillery headquarters local security plan. When the platoons are employed in direct support of divisions, the platoon headquarters' security measures are integrated into the supported division artillery security plan.

b. Searchlight Sections. The defense of each searchlight position must be coordinated with the security system of the nearest unit. Communica-

tions are established with that unit as an essential part of such defensive measures.

30. Camouflage

a. As the battery elements occupy their respective positions, every effort must be made to maintain the initial appearance of the area. In most positions, camouflage is attained by use of the issue camouflage net garnished with burlap strips or natural vegetation. For a detailed discussion of camouflage techniques, see FM 5-20.

b. Considerations of concealment sometimes conflict with protective measures against shellfire or bombing. In such cases, the battery (platoon) commander(s) must weigh the relative advantages and disadvantages of each in selecting and camouflaging the area. For example, a position under trees may provide excellent concealment, but the danger of shells or bombs striking the trees may outweigh the advantage of concealment.

31. Searchlight Emplacements

a. General. The searchlight emplacements should meet the following requirements:

- (1) Permit the section to accomplish its searchlight missions.
- (2) Afford maximum concealment.
- (3) Afford quick movement of the searchlight to alternate positions.
- (4) Provide maximum all-around protection for personnel and equipment against small-arms fire, artillery fire, and aerial bombardment.

b. Preparation of Emplacements. When advance notice of a mission or move is obtained in sufficient time, the battery (platoon) commander(s) should have positions for the searchlights prepared prior to the arrival of the searchlight sections.

c. Alternate Positions. Alternate positions for the searchlights should be selected and prepared. If time is available, the preparation of the alternate

position may be as detailed as that accomplished at the main position. This is particularly true when the unit is on the defense and the enemy possesses a capability to attack with superior forces.

d. Supplementary Positions. Supplementary positions should be selected and, time permitting, prepared for the illumination of targets that cannot be reached from the primary or alternate positions.

CHAPTER 5 COMMUNICATION

Section I. GENERAL

32. General

The ability of a searchlight battery to furnish effective support depends on efficient communication. Communications must be reliable and flexible. The commander must always consider the effect of communication upon the employment of the battery. Within the limits of the unit's capabilities, the commander provides adequate communications with elements of his command and with supported and adjacent units. The commander insures that all personnel of his command are adequately trained in the use of the several means of communications. (For a detailed discussion of field artillery communication, see FM 6-10.)

33. Special Communication Considerations

- a. The searchlight battery is generally deployed

over a corps front. The installation, maintenance of wire lines, and the great distances involved make assistance from the supported unit necessary for successful operation. The area communication system, installed by the Signal Corps, is used to augment artillery communication systems and is used as an alternate means of communications. The area system offers a means for expeditiously establishing a wire network between artillery elements when the length of lines required is beyond the capabilities of the units to establish and maintain.

- b. Deployment in counterinsurgency operations may encompass extended distances. Such distances and the nature of insurgent activity increase reliance upon radio as the primary means of communication (para 39).

Section II. WIRE COMMUNICATION

34. General

The searchlight battery makes maximum use of existing wire lines. The type of wire system installed depends on the length of time the position is to be occupied. Each searchlight platoon will generally operate as a separate tactical unit; therefore, the discussion of platoon communication requirements will pertain to each platoon. When a position is to be occupied for a relatively short period of time, only direct circuits should be installed between the supported unit and the light direction center. Wire circuits parallel the radio channels and take over the communication load as they are installed. Wire systems are expanded and improved by the installation of additional local lines, duplicate circuits, and lateral lines until the wire net fulfills the communication requirements of the situation.

35. Wire System Installation

Wire systems (fig. 5) are installed in order of

priority as determined by the assigned mission, the tactical situation, and availability of personnel and equipment. Wire circuits should be installed to provide—

- a. The minimum wire circuits necessary to perform the primary mission of the battery.
- b. Additional circuits for command and control.
- c. Expansion of remaining communication requirements.

36. Installation Priority

The wire circuits that are necessary to accomplish the assigned mission normally are installed as follows:

- a. Local circuits (telephone to switchboard) from—
 - (1) The corps artillery FDC to the battery switchboard.
 - (2) The platoon LDC to the supported division artillery FDC switchboard.

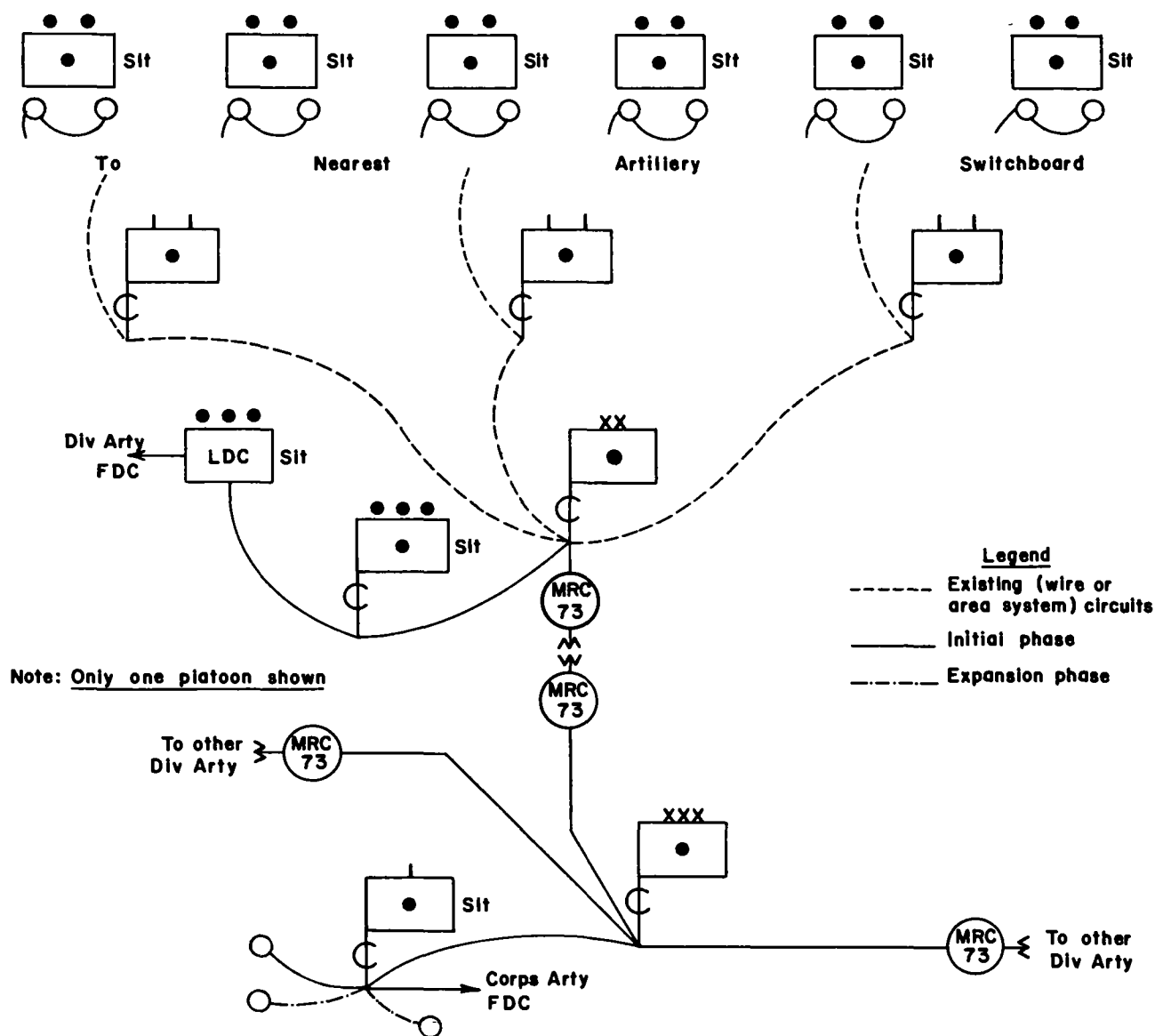


Figure 5. Type wire system, field artillery searchlight battery.

(3) Each searchlight section to the nearest artillery switchboard.

b. Direct circuits (telephone to telephone)—between the two telephones of each searchlight section.

c. Trunk circuits from—

(1) The corps artillery switchboard to the battery switchboard.

(2) The platoon switchboard to the supported division artillery switchboard.

d. Local circuits (switchboard to telephone)—from platoon switchboard to platoon LDC.

37. Other Priorities (Improvement)

Additional circuits may be installed for improvement and will be accomplished as the mission and situation dictate. This phase also includes policing and maintaining existing circuits.

38. Wire Installation Responsibilities

a. *Battery Wire Section.* The battery wire personnel install and maintain all internal lines of the searchlight battery and platoons.

b. *The Supported Unit.* Wire personnel from the searchlight battery install and maintain wire lines

to the supported artillery switchboard. (*Example:* From the searchlight section to an artillery switchboard, forward switch, etc.) When personnel and equipment necessary for the installation and maintenance of these circuits are not available, the

circuits will be installed as directed by higher headquarters.

c. Corps Artillery. Wire personnel from the searchlight battery headquarters will install and maintain circuits to corps artillery headquarters.

Section III. RADIO COMMUNICATION

39. General

Initially, upon occupation of position, radio communication is used. As the wire nets are established, radio traffic loads should decrease. Radio is then used only when the wire system fails, is overloaded, or does not include a particular installation. In counterinsurgency operations, greater reliance must be placed on radio communication than wire, because of the vulnerability of wire to insurgent action.

40. Radio Facilities

a. General. Installation of the radio equipment organic to the searchlight battery will be as shown in figure 6. The distribution of this equipment may be modified to accomplish a particular mission (i.e., task force operations).

b. Channels and Frequencies. Radio channels and frequencies are assigned to the battery by the corps signal officer in the signal operating instructions. The number of channels and frequencies assigned to a searchlight battery depends on the requirements of the situation and the number available. Normally, the searchlight battery headquarters will require only one channel for use as the battery net.

c. Battery Radio Sets in Other Nets. In addition to the net(s) established within the battery, elements of the searchlight battery operate in or monitor other nets. These nets include the corps artillery command/fire direction net FM, the division warning net, AM, the supported division artillery command/fire direction net, FM, and other nets as directed.

d. Type Battery Radio Systems. Figure 6 illustrates a typical battery radio system when each platoon is in direct support of a division.

41. Radio Nets

a. Battery Command Net. The battery command net is used for the transmission of administrative and tactical messages among elements of the battery.

b. Corps Artillery Command/Fire Direction Net, FM. The battery commander and the battery headquarters radio sets operate in the corps artillery command/fire direction net, FM. The battery receives command and administrative messages from corps artillery over this net.

c. Division Warning Net, AM. The battery headquarters and each platoon monitor this net. Warnings include air alerts; chemical, biological, and radiological (CBR) attacks; nuclear strikes; fallout information; and other warnings of an urgent operational nature. This information should be rebroadcast over the battery command net.

d. Supported Division Artillery Command/Fire Direction Net, FM. Each platoon operates in the supported division artillery command/fire direction net, FM. This net is used primarily for the exchange of command and administrative messages and for coordination between the platoon and the supported division artillery headquarters. This net is used by the platoon leader to conduct liaison with the supported unit.

e. In counterinsurgency operations, searchlight platoons and sections may be required to operate in other than United States forces communications nets. Such nets would be indicated by the assigned tactical mission (FM 6-20-1) or specified in the operations order.

42. Communications Security

a. Communication intelligence affords the enemy a means of obtaining information of plans and operations by intercepting messages or of locating transmitters and thereby locating command posts and other important installations.

b. The effectiveness of enemy intelligence activities cited in *a* above, can be reduced significantly by—

- (1) Enforcing rigid net discipline.
- (2) Using correct radiotelephone procedures.
- (3) Using approved codes.



CHAPTER 6

BATTLEFIELD ILLUMINATION

Section I. DIRECT ILLUMINATION

43. General

Searchlight illumination should provide friendly forces with sufficient light to assist them in the conduct of operations at night and yet deny equal advantage to the enemy. Direct illumination is provided by placing the searchlight beam on the target (fig. 7). Maximum illumination is obtained from the searchlight when it is used in this role. The usable range of a focused beam (52 mils wide) on a clear night is approximately 9,100 meters. The searchlight beam can be spread to 180 mils (spread beam) to cover a larger area, but an increase in beam width decreases the effective range and intensity of the light on the target.

44. Characteristics of Direct Illumination

a. An observer using direct illumination and having the light source at his back can observe into the illuminated area nearly as well as in daylight. Deep shadows cast by brush and other objects, because of low elevation of the beam, may provide concealment for enemy troops. The shadow effect can be minimized by using two or more searchlights spaced laterally and directed into the same general area. Objects silhouetted between a flank observer and the cone of light are clearly visible for several hundred meters.

b. Accuracy of fire is improved by direct illumination of the target area. Direct fire weapons can be

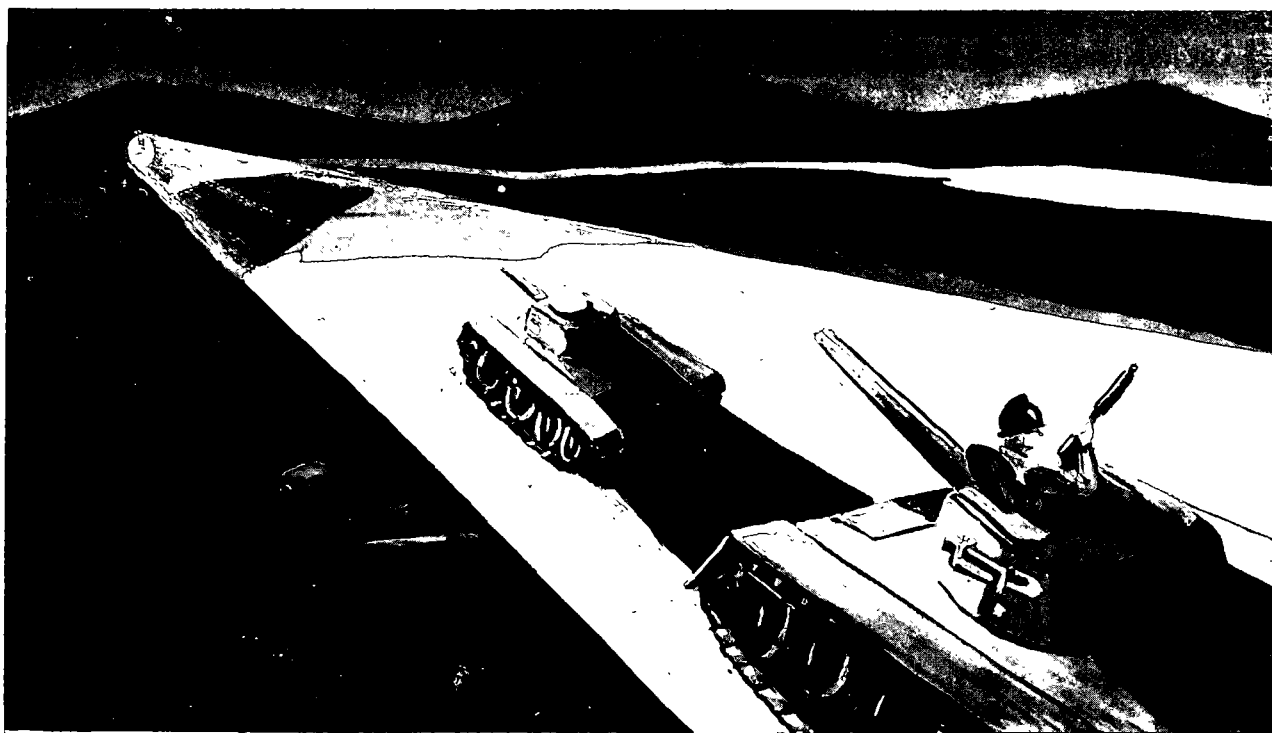


Figure 7. Direct illumination.

fired into the lighted area with an accuracy approaching that obtained in daylight operation.

c. Direct observation of the light source at relatively close range dazzles an observer within the beam, causing temporary night blindness. Either a continuous beam or intermittent flashes can be used to cause loss of night vision among enemy troops. For an observer in the beam, observation of objects toward the light source is limited, even with the eyes shaded. Additionally, it is difficult for an observer so located to estimate the range to the searchlight.

45. Capabilities of Direct Illumination

Direction illumination may be employed in forward areas for varying periods of time under all but the most adverse weather conditions to—

- a. Provide a flexible and an economical means of small- or large-area illumination for long periods of time.
- b. Provide sufficient light in a limited area to permit aimed fire of direct fire weapons, adjustment of indirect fire, and surveillance.
- c. Mark targets for close air support of other services, and for army aircraft discrete suppressive fires and other activities.
- d. Illuminate the objective in the assault phase of a night attack.
- e. Deny enemy infiltration or canalize enemy infiltrating groups or attacking formations into a less desirable avenue of approach.
- f. Facilitate movement of troops and vehicles, construction, minefield operations, evacuation of casualties, and resupply operation with the ease and speed approaching that possible during daylight.
- g. Increase morale and confidence of friendly troops when they have been oriented to, and trained in, the use of illumination.

46. Limitations of Direct Illumination

The use of direct illumination has the following limitations:

- a. Care must be exercised in emplacement to avoid silhouetting friendly troops and installations and to obtain illumination in the desired area without creating deep shadows.
- b. Night vision of friendly troops in the vicinity may be temporarily impaired, and an illumination failure during the course of an operation may result in confusion during adjustment of the eyes to the darker condition.

c. The searchlights may become an objective for infiltrating forces, in which case additional security elements may be required.

d. During offensive operations, tactical surprise may be lost by the use of searchlights unless prior illumination deception has been employed.

e. Enemy offensive and defensive operations may be benefited.

f. Searchlights may draw enemy fire. Although this fire may be ineffective on the searchlight position, other friendly installations in the vicinity may be damaged or harassed by the fire.

47. Uses of Intersecting or Single Beams

A single searchlight beam or an intersection of two beams may be used to—

- a. Assist adjustment of artillery fire.
- b. Mark terrain features or serve as a guide for patrols, raiding parties, or attacks.
- c. Signal widespread units of the commencement of a coordinated attack or similar movement.
- d. Indicate major terrain features to aid the movement of larger forces.
- e. Mark targets for high or low level aerial bombardment.
- f. Guide airborne elements to drop zones.
- g. Orient light aircraft in direction and location, and mark targets for army aerial fire support missions.

48. Factors Affecting Direct Illumination

a. *General.* Searchlights employed in direct illumination may be affected by atmospheric conditions, moonlight, terrain, and enemy activity. Because these factors play a vital part in formulation of the illumination plan for any operation, plans must be kept flexible for varying conditions.

b. *Atmospheric Conditions.* On clear, moonless nights, searchlights may be operated at maximum ranges. Light rain, haze, mist, smoke, or fog will decrease the effective range of the searchlight beam. Dense fog, heavy snowfall, or very heavy rain will make the searchlights ineffective. Atmospheric conditions reduce the effective range of illumination in proportion to the reduction in normal visibility.

c. *Moonlight.* Moonlight will not materially decrease the value of direct illumination although the light intensity may appear to be less because of the reduced contrast between illuminated and nonilluminated areas. Under moonlight conditions

the visible contrast between directly illuminated and nonilluminated areas will persist to approximately one-half the usable range of the searchlight.

d. Terrain. Mountainous or uneven terrain pre-

sents many situations that must be overcome by deliberate reconnaissance and siting of the searchlight. This terrain may cause large shadowed areas into which the direct beam cannot be directed.

Section II. INDIRECT ILLUMINATION

49. General

a. Illumination by Diffusion. Diffused illumination is obtained by directing the beam of the searchlight at a minimum elevation above the ground (fig. 8). The area beneath and to the flanks of the beam is illuminated by the light scattered by atmospheric particles. The intensity of illumination on the ground decreases gradually as the range from the searchlight and lateral displacement from the center of the beam increase. The lower the elevation, the greater the intensity of light on the ground beneath the beam, but the width of the illuminated area to the flanks is reduced as the elevation is reduced. Best results are obtained by using a focused beam and an elevation of less than 75 mils. Searchlights laid at greater elevations will produce less intense illumination but over a slightly wider area, and will reduce the effective range of illumination. Hill masses and woods cast shadows in the illuminated area. Illumination in wooded areas is less intense than in open areas and the degree of intensity depends on the density of the woods. On clear, dark nights, the maximum diffused illumina-

tion is approximately equal to that obtained from a quarter moon.

b. Illumination by Reflection. Reflected illumination is obtained when the searchlight beam is directed against low lying (150 to 900 meters) clouds (table II). The area illuminated receives light by reflection (fig. 9) of the beam from the clouds as well as by diffusion. The area beneath the point of reflection receives a higher intensity of illumination than can be obtained from diffusion alone. Illumination equivalent to that from a full moon may be obtained from a beam reflected off low clouds. Fog, mist, or rain beneath the cloud base or a decrease in the thickness of the cloud base itself will decrease the area and intensity of illumination. Best results are obtained by using a focused beam. The best cloud condition for illumination by reflection is 100 percent cloud coverage; however, reflection can be used satisfactorily with a minimum of 60 percent cloud coverage. Computation of the angle of elevation necessary for proper reflection onto the target area is covered in paragraph 79f.

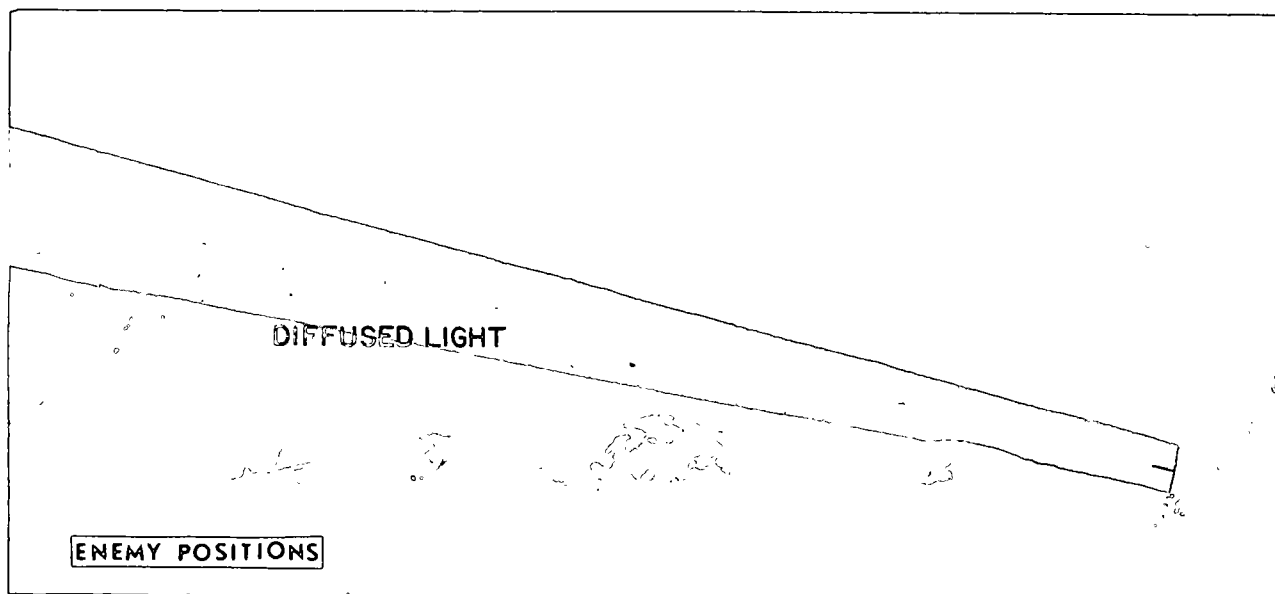


Figure 8. Illumination by diffusion.

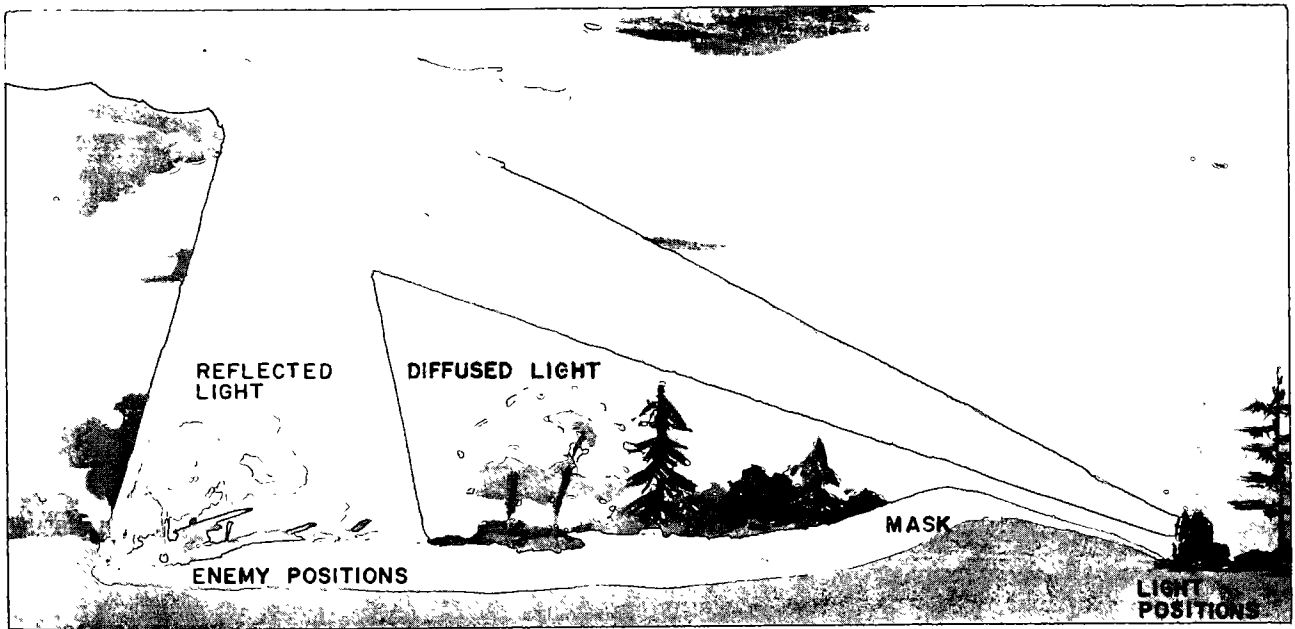


Figure 9. Illumination by reflection.

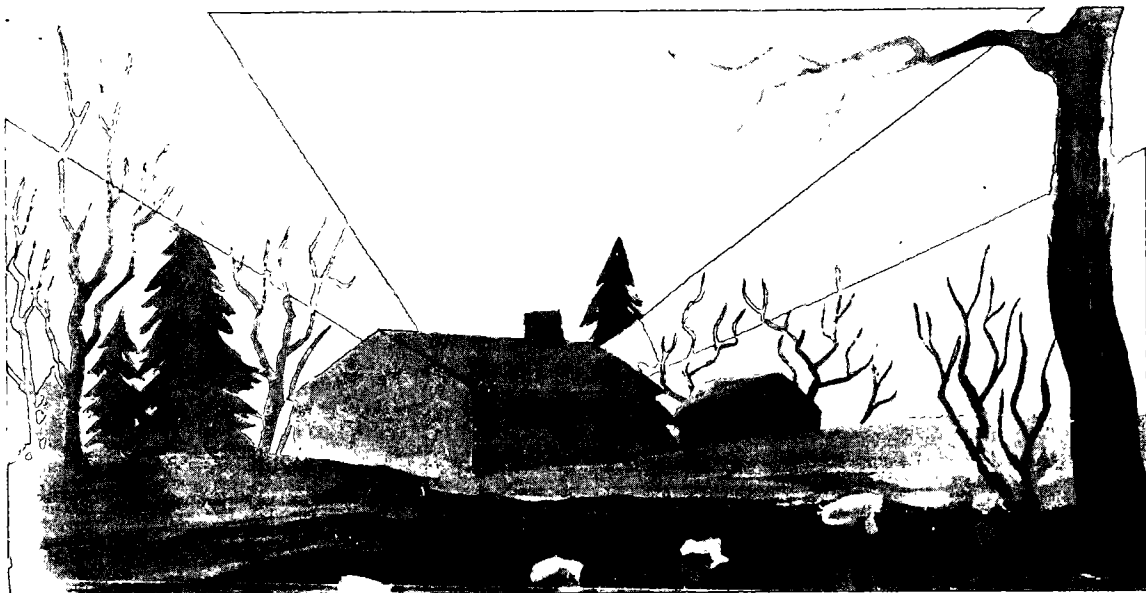


Figure 10. Appearance of terrain to observer looking toward source of light.

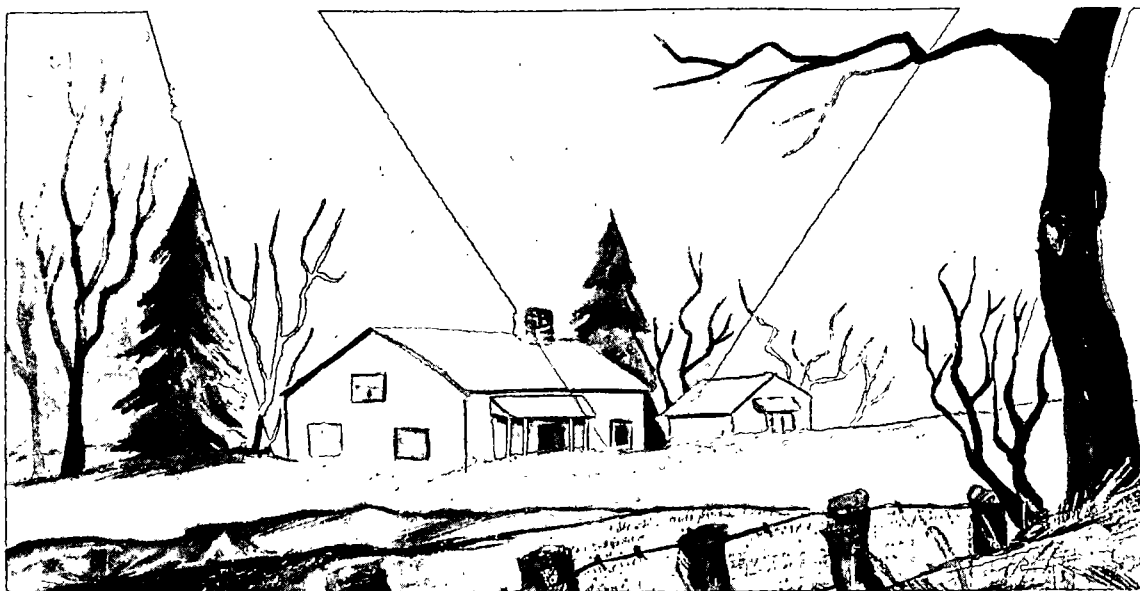


Figure 11. Appearance of terrain to observer looking away from source of light.

50. Characteristics of Diffused Illumination

a. General. Diffused illumination is accomplished when the searchlight beam is directed at a low elevation over the area to be illuminated. When the elevation of the beam is 100 mils or less, deep shadows are cast forward, and observation toward the source of light is difficult because of the beam glare (fig. 10). Elevating the beam reduces the shadow and glare effects as well as the light intensity. Diffused light illuminates hollows, draws, and tree-lined roads which ordinarily would not be illuminated to the same degree that they would be illuminated by a moon low on the horizon. For the observer looking *away* from the source of light, observation within areas illuminated by indirect, diffused light approximates observation conditions equivalent to illumination of a quarter moon (fig. 11). An observer *facing* the searchlights can usually see only one-third the distance seen by an observer who has his back to the searchlight.

b. Unaided Observation. When diffused illumination is equivalent to the light of a quarter moon, an observer looking *away* from the light source may detect an object the size of a man, against a background of average contrast, at distances up to 100 meters. A light background, such as sand or water, increases observation ranges. A dark background, such as dense woods, reduces observation ranges. When an observer is looking *toward* the light source, observation is reduced as indicated in *a* above.

When an object being observed is silhouetted against the light beam or against the illuminated sky, the ability to see does not increase in direct proportion to the intensity of the illumination. On a clear, moonless night, a 100 percent increase in illumination may result in a like increase in observing range; but, when the equivalent light of a quarter moon is present, a 100 percent increase in illumination may result in only a 10 percent increase in observing range.

c. Observation with Binoculars. An observer using 6 x 30 binoculars can detect a man standing against a light background at ranges up to about 800 meters when he (1) is looking away from the light source, or (2) employs diffused illumination equivalent to the light of a quarter moon. Looking toward the light source with binoculars will aid the observer; however, the distance to which he can observe will be only one-half to one-third of that obtained when he is looking from the light (fig. 12).

Binocular power	Light intensity equal to quarter moon	Light intensity equal to one-eighth moon
6 X 30	800 meters	600 meters
7 X 50	900 meters	700 meters

Observing ranges are only one-half to one-third of the ranges listed in Table above when observation is toward the source of light.

Figure 12. Observation, with binoculars, away from the source of light—diffused illumination.

d. Adjustment of Fire. Sighting of weapons is facilitated by diffused illumination, although the light is not adequate to permit aimed fire unless the sights are illuminated. Small-arms fire can be directed into specific areas when large objects can be identified. Adjustment of indirect artillery fire is about the same as adjustment of fire in the light of a quarter moon. Determination of the location of an enemy weapon is assisted materially because the flash can be located with respect to the position of the main searchlight beam and the discernible outline of terrain features.

51. Characteristics of Reflected Illumination

Reflected illumination has the same general characteristics as diffused illumination. Illumination by reflection from clouds has less directional effect than illumination by diffusion because the reflecting cloud is the source of overhead illumination. The directional effect close to the searchlights is almost the same for reflected illumination as for diffused illumination. Beneath the point of reflection, there is little or no difference in observing toward or away from the searchlights. The enemy, therefore, is aided by reflected illumination to a greater degree than by diffused illumination. The sighting of weapons and the adjustment of fire are facilitated in general to the same degree by either reflected or diffused illumination.

52. Capabilities of Indirect Illumination

Indirect illumination may be employed continuously to—

a. Provide for limited surveillance when the light source is to the rear of the observer.

b. Provide direction for friendly elements and activities such as patrols and raiding parties.

c. Support direct or indirect fire.

d. Facilitate movement of troops, transport, resupply, evacuation of casualties, and movement into and out of positions.

e. Assist in defensive operations, such as mine-laying and the construction of barriers, and in hampering enemy air observation.

53. Limitations of Indirect Illumination

In addition to the limitations of direct illumination listed in paragraph 46, the use of indirect illumination has the additional limitation of reducing friendly air observation by screening. The blanket of light over the target area limits observation through it into the area below.

54. Factors Affecting Indirect Illumination

a. General. Indirect illumination is influenced by the same factors that affect direct illumination though not necessarily in the same manner.

b. Atmospheric Conditions. Light rain, haze, mist, smoke, or fog increase illumination by diffusion at midranges. However, extremes of these conditions will result in ineffective indirect illumination.

c. Moonlight. On a clear night when the moon is full, indirect illumination does not increase visibility unless the moon is low on the horizon.

d. Terrain. Indirect illumination by the searchlight generally has the same capability as direct illumination in mountainous or uneven terrain. The intensity and the quality of illumination vary with the texture and color of the terrain surface.

Section III. OTHER OPERATIONS

55. Illumination in Rear Areas

The versatility of searchlight employment in rear areas is limited only by the commander's ingenuity and imagination. Searchlights can be used in rear areas to illuminate road nets and supply routes; to facilitate the unloading and classification of supplies on beachheads, ports, or depots; and to facilitate the construction of bridges, airfields, and other facilities. For general illumination over large areas, indirect illumination techniques are used. For specific illumination of small local areas or job sites, either indirect or direct illumination may be used.

56. Methods of Employment

a. Illumination of Job Sites. When searchlights are used to illuminate job sites, the lens can be covered by material such as bed sheets, mattress covers, or target cloth, or the beams may be reflected off walls, trees, or artificial screens. Direct illumination by means of a covered searchlight is best. Job-site illumination by reflection from water surfaces or metallic reflectors has serious glare effects that may interfere with the operation of the working party. When a single searchlight is employed and the system of reflecting the light is used, deep

shadows are cast by the light. The use of two or more searchlights will eliminate most shadows.

b. Illumination of Road Nets and Rear Areas. When searchlights are used to illuminate road nets and rear areas, the best results are obtained by indirect illumination. Direct illumination should be avoided in these areas. Particular care must be taken in sighting the searchlights along a road in order to avoid dazzling the drivers of motor vehicles. In general, the searchlights should be located so that the light forms a cone over the area to be illuminated.

c. Illumination in Support of Psychological Operations. When searchlights are employed to support psychological operations, illumination missions may

be conducted to attract attention to loudspeaker broadcasts or leaflet drops, and for harassment of insurgent forces. Other psychological operations which may include the employment of searchlights are discussed in FM 100-20, FM 31-16, and FM 31-21.

d. Illumination in Support of Military Civic Action. Searchlight units may be employed to provide illumination for civic action projects. For additional details on military civic action, see FM 100-20, FM 31-22, and FM 31-73.

e. Additional Information. Additional guidance regarding counterinsurgency operations may be found in FM 6-20-1, FM 100-20, FM 100-5, and FM 31-16.



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CHAPTER 7

ILLUMINATION PLANNING

Section I. GENERAL

57. General

a. Echelons of Planning. Illumination planning is accomplished at all echelons of command and may originate at any echelon. Target acquisition is performed by all target locating agencies. The same artillery channels and procedures of coordination used in conventional fire planning are used in illumination planning.

b. Sequence of Planning. Illumination planning is continuous. It starts upon receipt of the mission of the supported unit and is conducted concurrently with artillery fire planning.

c. Principles of Illumination Planning. The principles of illumination planning are as follows:

- (1) Sufficient light must be provided to assist friendly forces in the conduct of operations at night and, where possible, to deny any advantage to the enemy.
- (2) Continuous support must be provided the attacking or defending forces at night.
- (3) Coordination must be accomplished with the supported unit and with supporting artillery, naval gunfire, and tactical aircraft.
- (4) Illumination must be consistent with the situation.
- (5) Coordination must be accomplished with adjacent units.
- (6) Illumination planning must be continuous.

58. Target Acquisition

Any agency may request illumination of an area. The location of the area and duration of the illumination must be specified in the request. Personnel will not be employed solely to locate targets suitable for illumination. Artillery staffs at all levels are responsible for processing information relating to critical areas that require illumination. All target locations are examined with illumination requirements in mind.

59. Target Analysis

Each potential target for illumination must be analyzed by the planner to determine its military importance, the necessity for illumination, its relative priority for illumination, and the capabilities of available illuminants for such illumination. In making his target analysis, the illumination planner will employ those techniques outlined in FM 6-20-2.

60. Employment of Battlefield Illumination Means

The illumination planner has three principal means to illuminate the battlefield—searchlights, artillery and mortar illuminating shells, and aircraft flares. The following criteria are used to determine the means of illumination to be employed on a specific target:

a. Duration. When illumination is planned for a long duration, searchlights should be used. The available ammunition supply and the factors affecting the resupply rate will limit illumination by mortar or artillery shell, while the availability of aircraft and/or flares will limit illumination by aircraft flares. Searchlights can illuminate almost continuously except for an approximate 1-minute interruption each 6 hours to change the negative carbon, and for about 5 minutes during each 4 hours of continuous operation for refueling the generator. Artillery and mortar illuminating shells illuminate from 1 to 2 minutes. Continuous illumination can be provided by any of the means but is most economically accomplished with searchlights.

b. Intensity. The intensity of light required on the target must also be considered in selecting the means of illumination. When a soft, diffused light is required, indirect lighting by searchlights may be used. Direct illumination by searchlights, illuminating shells, or aircraft flares may be used when a greater intensity is required.

c. Shadows. Direct illumination by one searchlight provides steady, intense illumination, causing exaggerated shadows in which target detection is difficult. Aircraft flares and illuminating shells employ a flare suspended from a parachute. This flare may swing like a pendulum causing the ground shadows to move, thus making target detection difficult. Shadow effects of both flares and searchlights can be minimized by multiple light sources, such as two or more flares and/or two or more searchlights employed simultaneously. Indirect reflected illumination by a searchlight, although of an intensity approaching full moonlight below the point of reflection, provides a softly shadowed area of illumination.

d. Accuracy. A searchlight beam adjusted on a target area will remain accurately placed until moved and, if moved, can be accurately returned to the same target area. Aircraft flares are difficult to adjust, and successive flares dropped from approximately the same altitude will differ in accuracy on the target owing to wind-caused drift and differences in the flare parachutes (FM 20-60). Illuminating shells are affected by the weather to the same extent as are other artillery projectiles; their points of burst can be predicted with accuracy. However, as with aircraft flares, differences in effect on the target may be caused by variations in the functioning of the flare parachutes.

e. Effect on Adjacent Units. Illumination cannot ordinarily be confined to a specific area. Direct searchlight illumination is the most easily controlled of all illuminating means. Wind-caused drift and the height of burst affect the size of the area illuminated by an aircraft flare or illuminating shell. Care must be taken to avoid illuminating adjacent units' areas which may adversely affect the accomplishment of the adjacent units' mission.

f. Availability of Other Means. The use of illuminating shells may be limited by the available supply or the nonavailability of transportation required to carry the ammunition forward. The use of aircraft flares may be limited by the effect of weather on the aircraft flight; consequently, they are not suitable for all-weather delivery. The searchlight will generally be limited only by the availability of suitable position areas. An inspection of the searchlight units' visibility diagrams will indicate the fields of illumination possible from available positions.

61. Factors Affecting Battlefield Illumination

Certain external factors affect the efficiency of searchlight illumination (para 60). If, in consideration of these circumstances, searchlight illumination proves impractical, aircraft flares or illuminating shells may be used. The following factors must be considered in planning battlefield illumination:

a. Weather. Information of anticipated weather conditions must be obtained from appropriate weather sources. Weather forecasts are studied to aid in determining the best means of illumination. Cloud conditions are particularly important in planning indirect searchlight illumination by reflection.

b. Terrain. Map studies (and studies of visibility diagrams for direct illumination) accompanied by ground reconnaissance whenever possible, are necessary to determine the suitability of searchlight positions for the fulfillment of the assigned mission.

c. Moonlight. The phase and position of the moon during periods of illumination can be determined from the current TM 6-300-series, the Army Ephemeris, or from other ephemerides and almanacs. Higher headquarters and air weather detachments can frequently provide such data.

Section II. ILLUMINATION PLAN

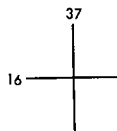
62. Illumination plan

The illumination plan is prepared at the division artillery fire direction center; it is based upon requests of supported units or as directed and is published as an appendix to the division fire support plan. Coordination is accomplished at corps to insure integration of battlefield illumination with fire support means and to coordinate the use of all means of illumination. The illumination plan (fig. 13) may consist of any or all of the elements in a

through *d* below. The degree of completeness is contingent on the amount of time available. The planning procedures outlined in FM 6-20-2 are followed in the preparation of these elements.

a. Written Portion. The written portion provides the who, what, where, when, and how information that is not shown graphically. No standard number of paragraphs or sequence of information is prescribed for the written portion.

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Appendix 5 (Illumination Plan) to Annex B (Fire Support Plan)
To OPORD 12

Maps: US 1:50,000, FORT SILL, MT SCOTT

1. 1st and 2d Brigade will attack abreast, 2d Brigade on the north, 3d Brigade reserve.
2. Priority of illumination to the 2d Brigade.
3. Concentrations in 2d Inf Div area as shown will be illuminated.

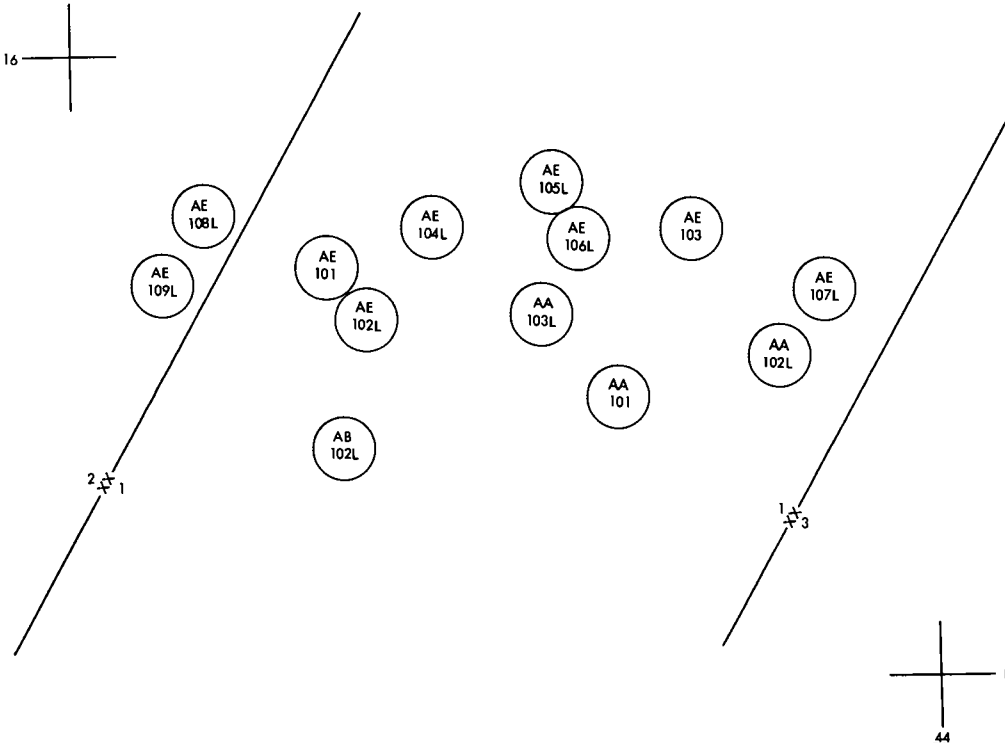
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Illumination Target Listing

CONC	DESCRIPTION OF TARGET	COORDINATES	ALTITUDE	AREA	REMARKS
AA 101	Road junction	41371342	340	200 meters	Illuminating shell
AA 102L	Avenue of approach	42831362	250	400 meters	Slit direct
AA 103L	Entrenchment	40811396	400	50 meters	Slit direct
AB 102L	Suspect OP	39111286	405	50 meters	Slit
AE 101	Suspect CP	39051430	395	200 meters	Slit
AE 102L	Avenue of approach	39251398	380	400 meters	Slit indirect
AE 103	Suspect CP	41961460	385	200 meters	Slit direct

SCHEDULE OF ILLUMINATION

UNIT		-10	-8	-6	-4	-2	H.	+2	+4	+6
BTRY D 1st ARTY (SLT)	1-1					AE 101				
	1-2							AA 102L		
	1-3							AA 103L		
	1-4					AE 102L				
	1-5					AE 102L				
	1-6					AE 103				
	2-1			AB 102L						
1st BN 10th ARTY	Btry A							AA 101		

Figure 13. Illumination plan.

b. Graphic Portion. There is no substantial difference between the graphic portion in the illumination plan and the corresponding portion of the artillery fire plan as outlined in FM 6-20-2. The method of concentration designation differs in that the concentration number is suffixed with the letter L; e.g., AA101L. This method applies to all concentrations designated as solely illumination concentrations. However, conventional artillery concentrations are also used to compute illumination data. Shown within this portion is such information as—

- (1) The location of concentrations, depicted by tick marks, and identified by the appropriate designation.
- (2) Coordinating and limiting measures.
- (3) Groups of concentrations to cover single areas too large to be covered by one concentration.

c. Illumination Target Listing. All concentrations shown in the graphical portion will be shown in the illumination target listing. All concentrations listed are available to be illuminated on call. One additional item described in the target listing of the illumination plan, which is not ordinarily described in artillery fire plans, is the size of the area to be illuminated. This is expressed as the diameter of a circle in meters.

d. Schedule of Illumination. The unit designated to provide the illumination and the duration of the illumination is included in the schedule of illumination. All scheduled illumination is listed. Illumination by artillery illuminating shell will be listed both on the schedule of illumination and on the artillery schedule of fires. The method of constructing this schedule is outlined in FM 6-20-2.

63. Planned Illumination and Targets of Opportunity

a. General. As with fire planning, illumination planning is continuous. The detail with which illumination planning is conducted depends on the time available for planning, the extent and accuracy of target locations, the type of operation in which the supported unit is engaged, the illumination requirements of higher echelons, and the means of illumination available.

b. Definitions. The following terms are used in illumination planning and should be understood by illumination planners:

- (1) *Scheduled illumination.* Scheduled illumination is that illumination which is planned both as to location and time. It is generally scheduled to fit a particular plan of maneuver.
- (2) *On-call illumination.* On-call illumination is that which is planned as to location but not as to time. It is generally planned for areas in which illumination requests are anticipated but in which scheduled illumination is neither practicable nor desired.
- (3) *Targets of opportunity.* Targets for which illumination is not planned are known as targets of opportunity. These areas may be illuminated on request from commanders of units in contact, observers, or any target locating agency. Requests for illumination may also be submitted in conjunction with requests for adjustment of artillery fires or other weapons.

CHAPTER 8

ADJUSTMENT OF ILLUMINATION

64. General

The procedure used by a forward observer in requesting a searchlight illumination mission and in adjusting the searchlight beam on a specific target is similar to the procedure used in adjusting artillery fire. Although some of the elements of an illumination request are different from those of a fire request, the sequence and descriptive wording parallel the form of the fire request.

65. Illumination Request

a. Elements of the Illumination Request.

<i>Element</i>	<i>Example</i>
Identification of observer.....	THIS IS NOBLE DELTA 44.
Warning order.....	ILLUMINATION MISSION.
Reference point or coordinates..	FROM CONCENTRA- TION A401L.
Azimuth from observer to target..	AZIMUTH 4820.
Shift.....	RIGHT 400, ADD 700.
Nature of target.....	SUSPECTED PATROL.
Type of adjustment.....	TWO LIGHTS.
Type of illumination.....	INDIRECT.
Beam spread.....	FOCUSED BEAM.
Control.....	WILL ADJUST OR, AT MY COMMAND FLICK.

b. Identification of Observer. The observer identifies himself to the unit from which he is requesting illumination by appropriate call signs or code.

c. Warning Order. The observer sends ILLUMINATION MISSION to alert the light direction center. The warning order indicates that a request for illumination follows.

d. Location of Target.

- (1) *Reference Point or Coordinates.* The location of the target may be given as a shift from a known point, by grid coordinates, or by polar coordinates.
- (2) *Azimuth from Observer to Target.* The observer determines the azimuth from his position to the target by the use of a com-

pass or other angle-measuring instrument, or a map. When no angle measuring instrument is available, the observer estimates the azimuth.

- (3) *Shift.* The observer may shift from a known point, which may be a registration point, a numbered artillery or illumination concentration, or he may shift from any other point the chart location of which is known at the LDC. The shift is given as corrections in meters, usually to the nearest 10 meters.

e. Nature of Target. The nature of the target consists of a brief description of the enemy installation, personnel, equipment, or activity which is observed. The nature of the target is preceded by the word SUSPECTED if positive identification of the target cannot be made.

f. Type of Adjustment. The number of searchlights desired on a particular mission is specified in the type of adjustment requested. If the type of adjustment is omitted, one searchlight will be used in adjustment.

g. Type of Illumination. The observer can request direct or indirect illumination. If the type of illumination is omitted, direct illumination will be used.

h. Beam Spread. The observer requests the beam spread necessary to illuminate the area under observation. The beam spread is designated as focused or spread beam. If the type of beam spread is omitted, a focused beam will be used.

i. Control. The observer's designation of control may be announced as WILL ADJUST, which indicates that subsequent adjustments of the initial beam will follow or AT MY COMMAND, which indicates that the illumination is required at a specific instant. The command AT MY COMMAND must be followed by the subsequent command FLICK at the actual time the observer is ready to observe.

66. Examples of Illumination Requests

- a. *Example 1.*
THIS IS NOBLE DELTA 44.
ILLUMINATION MISSION.
COORDINATES 386489.
AZIMUTH 1240.
SUSPECTED AUTOMATIC WEAPONS.
WILL ADJUST.
- b. *Example 2.*
THIS IS NOBLE DELTA 44.
ILLUMINATION MISSION.
FROM CONC A401L.
AZIMUTH 1600.
RIGHT 200, UP 20, ADD 600.
SUSPECTED PATROL.
WILL ADJUST.

67. Information Sent to Observer

a. If the target is to be illuminated, the light direction center furnishes the following information to the observer:

<i>Element</i>	<i>Example</i>
Searchlight(s) illuminating.....	NUMBER 3.
Type of illumination.....	DIRECT.
Concentration number.....	A101L.

- b. If the target is not to be illuminated, the observer is notified WILL NOT ILLUMINATE.
- c. When the observer has sent AT MY COMMAND, the light direction center transmits READY to indicate that the searchlights are ready to illuminate. The illumination is then provided on the observer's transmission of FLICK.

68. Subsequent Corrections

The observer makes all corrections in azimuth and elevation with reference to the searchlight-target line. When two searchlights are being used, each is adjusted individually. The only elements announced are those corrected. The omission of either an azimuth or elevation shift indicates that the element is to remain the same. If the observer desires to change the width of the beam spread, he commands INCREASE (REDUCE) BEAM SPREAD. This correction precedes the azimuth and elevation corrections. The azimuth and elevation corrections can be determined by either of the methods in a and b below.

a. *Beam Width Method.* In the beam width method, the width used is the diameter of the searchlight beam as viewed by the observer in the target area. The beam width varies with the range and width of beam spread, but, regardless of its size, a shift of one beam width will move the center of the illuminated area the width of the beam being used. Using the width of the searchlight beam as a unit of measure, the observer commands LEFT (RIGHT) (so many) BEAM WIDTHS, UP (DOWN) (so many) BEAM WIDTHS. The smallest correction given is LEFT (RIGHT) ONE-FOURTH BEAM or UP (DOWN) ONE-FOURTH BEAM.

b. *Shift in Meters Method.* In the shift in meters method, the observer determines a shift in the same manner as for the adjustment of artillery fire on the gun-target line. The smallest correction in meters which can be made by the observer is 10 meters.

CHAPTER 9

LIGHT DIRECTION

Section I. GENERAL

69. Principles

Light direction center (LDC) functions parallel those of the fire direction center (FDC) of an artillery battalion. A searchlight chart is prepared showing each searchlight position, the illumination capability of each searchlight, the zone of action, and areas where light concentrations are desired. Illumination requests are received from target locating agencies and illumination plans. These requests are processed and data are computed for the illumination mission. The decision to illuminate is made at the division artillery FDC with the corps commander's concurrence required whenever adjacent units may be affected.

70. Functions

The light direction center is prepared to direct searchlights on an area when illumination is requested. The light direction center will—

a. Maintain for each searchlight a record of the minimum elevations, capabilities, and probable time of recarboning.

b. Prepare data for various light concentrations on possible targets based on the illumination plan and intelligence received from corps artillery and other sources.

c. Direct the relief of a searchlight that must go out of action for any reason.

d. Control the sequence and time of illumination by searchlights.

71. Level of Operation

a. Each platoon establishes a light direction center in the vicinity of the supported division artillery's fire direction center. All searchlight data is produced at the platoon light direction center. When searchlights are operated in rear areas, such as in job-site illumination, a light direction center is not necessary and control may be decentralized down to the individual searchlight sections.

b. A capabilities chart is maintained at the battery command post. This chart is the basis for the battery commander's advice on illumination matters.

72. Physical Arrangement of the Light Direction Center

a. The light direction center may be located in a tent, in the back of a truck, in a house, or in any other suitable location. The light direction center is located in the vicinity of the supported unit's artillery fire direction center. The location must provide sufficient working space and protection from the elements and enemy action.

b. Figure 14 depicts the layout of a typical light direction center. Duty posts of personnel are indicated thereon.

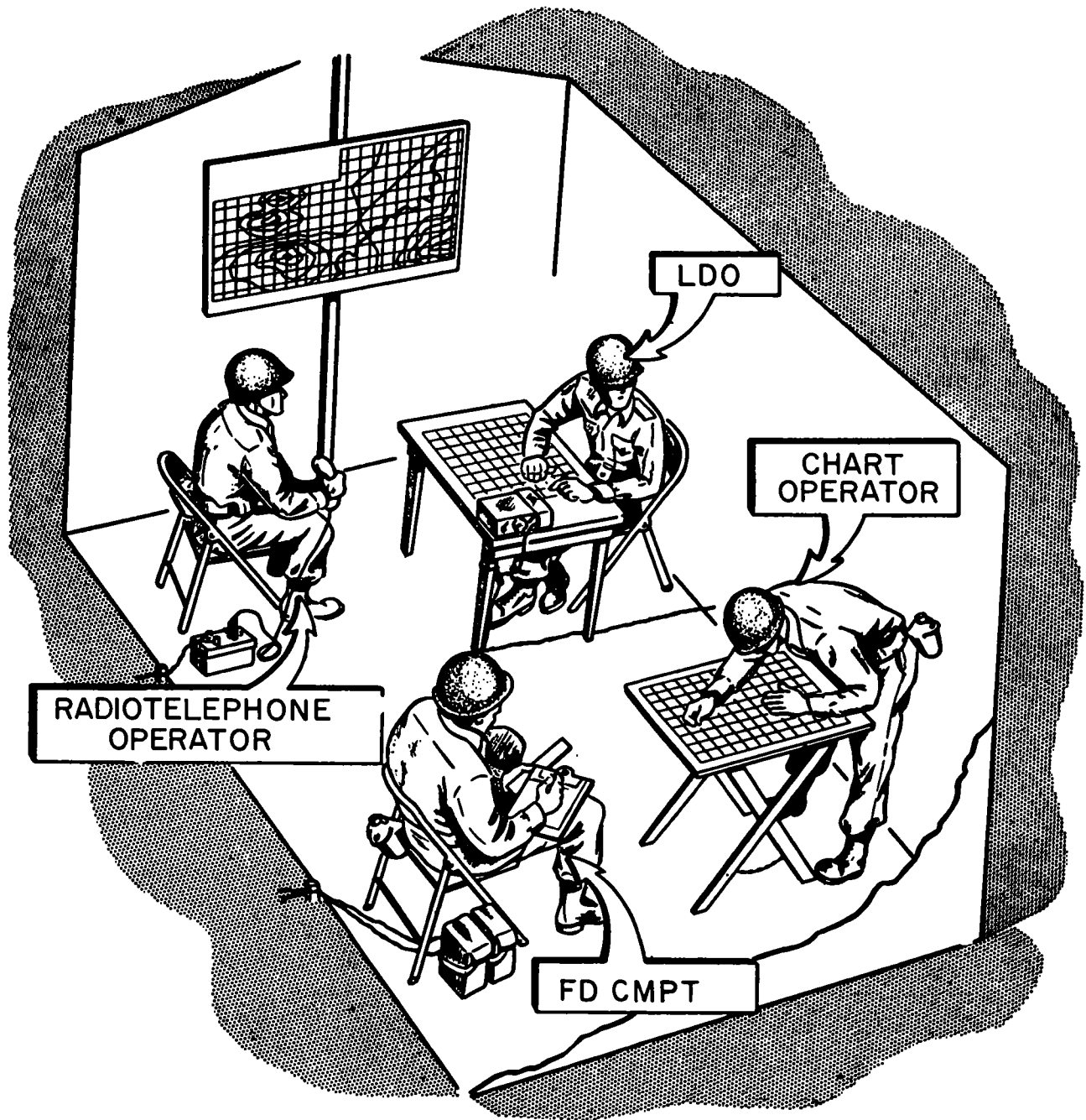


Figure 14. Light direction center.

Section II. LIGHT DIRECTION CENTER OPERATION

73. Preparation of Data

Data for delivering searchlight illumination is computed at the platoon light direction center. Data for scheduled and on call missions are prepared immediately upon receipt of the approved illumination plan. Data for areas in which illumination requests are anticipated should be computed as far in advance as possible.

74. Sources of Target Information

Targets to be illuminated by searchlights may be located and reported by supported units, by artillery liaison personnel with those units, by field artillery ground or air observers, by personnel of the field artillery target acquisition battalion (sound, flash, and radar), and by adjacent or higher headquarters.

Targets may also be located by analyzing photographs and by knowing the enemy's activities. A tentative description of the target should accompany the report; a request for fire and/or illumination may also accompany the report. If the report is to be of maximum value, it must be transmitted promptly.

75. Target Location

Target locations may be pointed out on the ground, designated by grid coordinates, designated by reference to a known point (such as a target previously illuminated or fired upon), designated by azimuth and range from an observation post, marked on maps or photographs, or traced on overlays of such maps or photographs.

Section III. DUTIES OF LIGHT DIRECTION CENTER PERSONNEL

76. General

The personnel of the light direction center are assigned specific duties, which are performed in a prescribed sequence and manner in order to provide efficient control.

77. Duties of the Light Direction Officer

a. General. The platoon commander, or the assistant platoon commander, acts as the light direction officer. He plans, coordinates, and supervises the activities of the light direction center and is responsible for the training of the personnel of the platoon.

b. Decision to Illuminate. The decision to illuminate will usually be made at the highest headquarters concerned. If all available searchlights are performing an illumination mission and an additional request for illumination is received, the light direction officer will refer the request to the S3 of the supported unit for an alternate means of illumination or for approval for termination of a searchlight mission already in progress to make a searchlight available.

c. Illumination Order. The light direction officer issues an illumination order upon receipt of an illumination mission. The order may consist of all or a portion of the elements in (1) through (5) below. These elements are sent to the observer conducting the mission for information and future reference.

Considerations affecting these elements are discussed in *d* through *h* below.

<i>Element</i>	<i>Example</i>
(1) Number and designation of searchlights.	NUMBER 3.
(2) Type of illumination.....	DIRECT.
(3) Beam spread.....	FOCUSED.
(4) Control of illumination....	WHEN READY.
(5) Concentration number.....	CONCENTRATION AA101L.

d. Number and Designation of Searchlights. The decision as to which searchlight(s) will conduct the mission depends on the—

- (1) Number of searchlights available.
- (2) Size of the area to be covered and the accuracy of its location.
- (3) Advisability of surprise illumination.
- (4) Importance of the target.
- (5) Angle T (should be not less than 100 mils for best observation when direct illumination is employed).

e. Type of Illumination. The type of illumination will depend on the intensity of illumination desired and the location of the searchlights in relation to the target area. If direct illumination is to be furnished, due consideration must be given to the enemy's countermeasure capabilities.

f. Beam Spread. The beam spread used for direct illumination depends on the searchlight target range. The focused beam provides the most usable range

whereas the spread beam provides a greater area of coverage but a resultant decrease in intensity and range. In general, the focused beam is used for indirect illumination.

g. Control of Illumination. The mission and effect desired govern the selection of illumination control, such as WHEN READY, TIME-ON-TARGET (TOT) (either with or without accompanying artillery fire), AT MY COMMAND, or any specified time according to a prearranged schedule.

h. Concentration Number. The concentration numbers assigned by the light direction officer are allotted by corps artillery to the searchlight battery just as for any other corps artillery unit. The concentration numbers differ only from artillery concentration designations by the suffix L, e.g., A101L. Illumination concentration numbers assigned by illumination planners at other echelons are selected from their ordinary artillery block of numbers and suffixed with the letter L.

78. Duties of the Chart Operator

a. Constructs the Light Direction Chart. The chart operator is a key member of the light direction center. He prepares and operates the light direction chart. The chart operator plots the searchlight positions on the light direction chart and maintains other information on the chart which may be of particular importance, such as the capabilities of each light, locations of friendly elements and observers, and limiting factors such as *areas not to be illuminated*. Because of the frequent change in these items of information, it may be more convenient to keep them on an overlay to the light direction chart. See FM 6-40 for a detailed discussion of plotting.

b. Operates the Target Grid. The target grid is a device for converting the observer's target locations with respect to the observer-target (OT) line to target locations with respect to the searchlight-target line (fig 16). The chart operator uses a target grid in conjunction with the light direction chart. For a detailed discussion of the use of the target grid, see FM 6-40.

c. Constructs Azimuth Indexes. The chart operator constructs azimuth indexes for the zone of responsibility of each searchlight as outlined in FM 6-40. These indexes are marked with their proper values and identified by the section and platoon designations.

d. Plots Targets. The chart operator plots all targets reported to the light direction center. Targets reported by coordinates are plotted by using the coordinate scale. To plot targets designated with respect to a reference point, the chart operator first orients the target grid. The chart operator then moves the plotting pin right or left (so much) along a line perpendicular to the arrow on the grid and adds or drops (so much) along the directional arrow or one of the lines parallel to it. In this manner, the target is plotted with respect to the OT line. The target grid is used in making the initial plot only. For a detailed discussion concerning the plotting of targets, see FM 6-40.

e. Determines and Announces Data. After completing the target plot, the chart operator places the vertex of the range-deflection protractor at the pin marking the searchlight position and places the range scales of the range-deflection protractor against the plotting pin marking the target location. Data are read and announced in the following sequence: *azimuth, range, and altitude*. The chart operator reads and announces only the data for the initial plot for the illumination mission. The computer processes all subsequent shifts. After the chart operator has announced the azimuth, range, and altitude for the initial plot, he is free to process another mission.

f. Announces Azimuth. The chart operator reads the azimuth for the searchlight from the deflection scale of the range-deflection protractor opposite one of the azimuth indexes for that searchlight and announces it to the computer. When the azimuth is announced to the computer, it is preceded by the word AZIMUTH; for example, NUMBER 3, AZIMUTH 300.

g. Announces Range. The chart operator reads the range for the searchlight or searchlights from the range scale of the range-deflection protractor opposite the target plotting pin and announces it to the computer. The range is announced immediately after the azimuth and always is preceded by the word RANGE; for example, NUMBER 3, AZIMUTH 300, RANGE 8000.

h. Announces Altitude. The altitude of the target is determined in one of several ways—it may be read from the light direction chart if the chart is a battle map; it may be computed when the observer shifts from a known point (the shift up or down is applied to the altitude of the known point); or it may be assumed to be the same as the altitude of

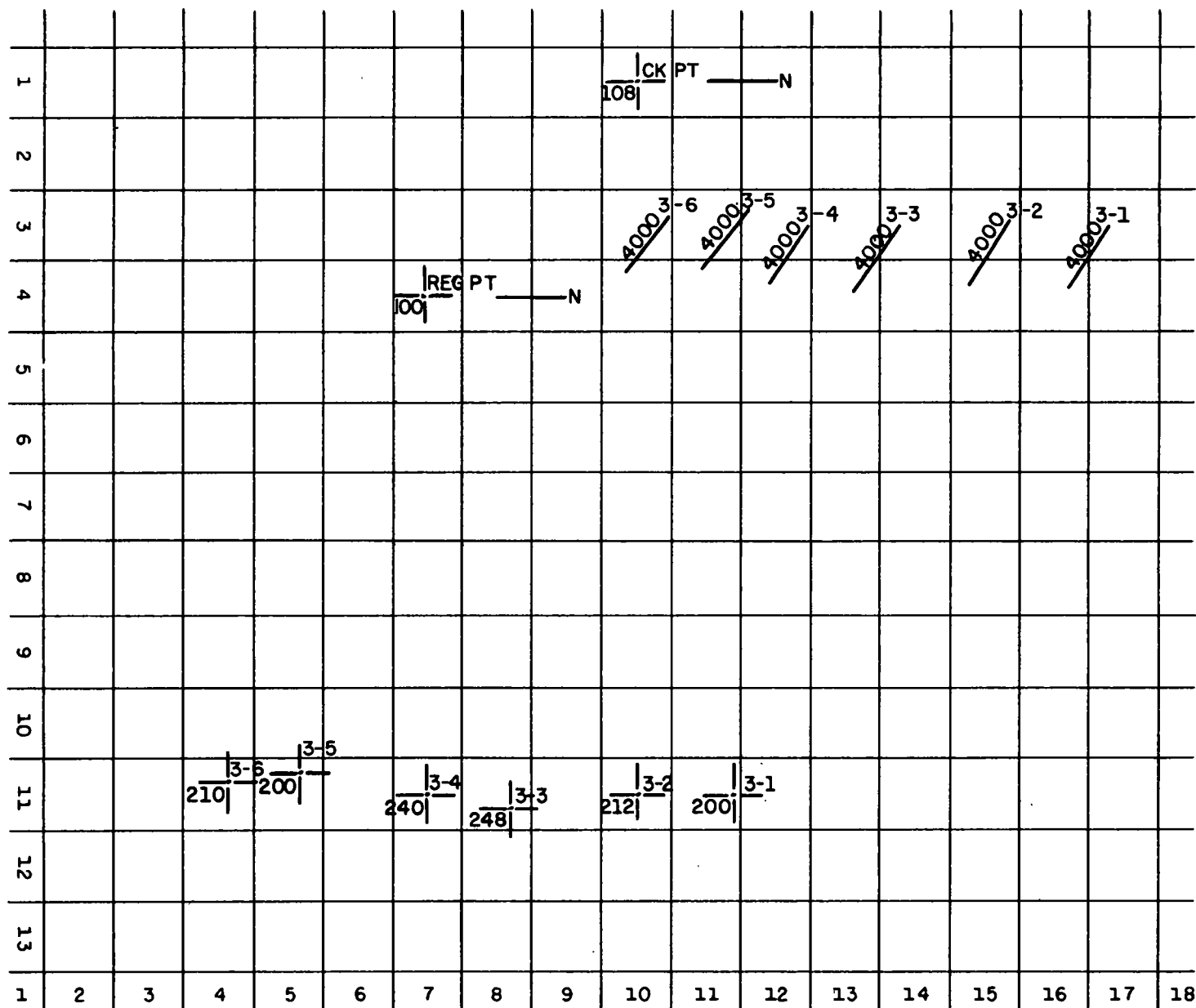


Figure 15. A light direction chart.

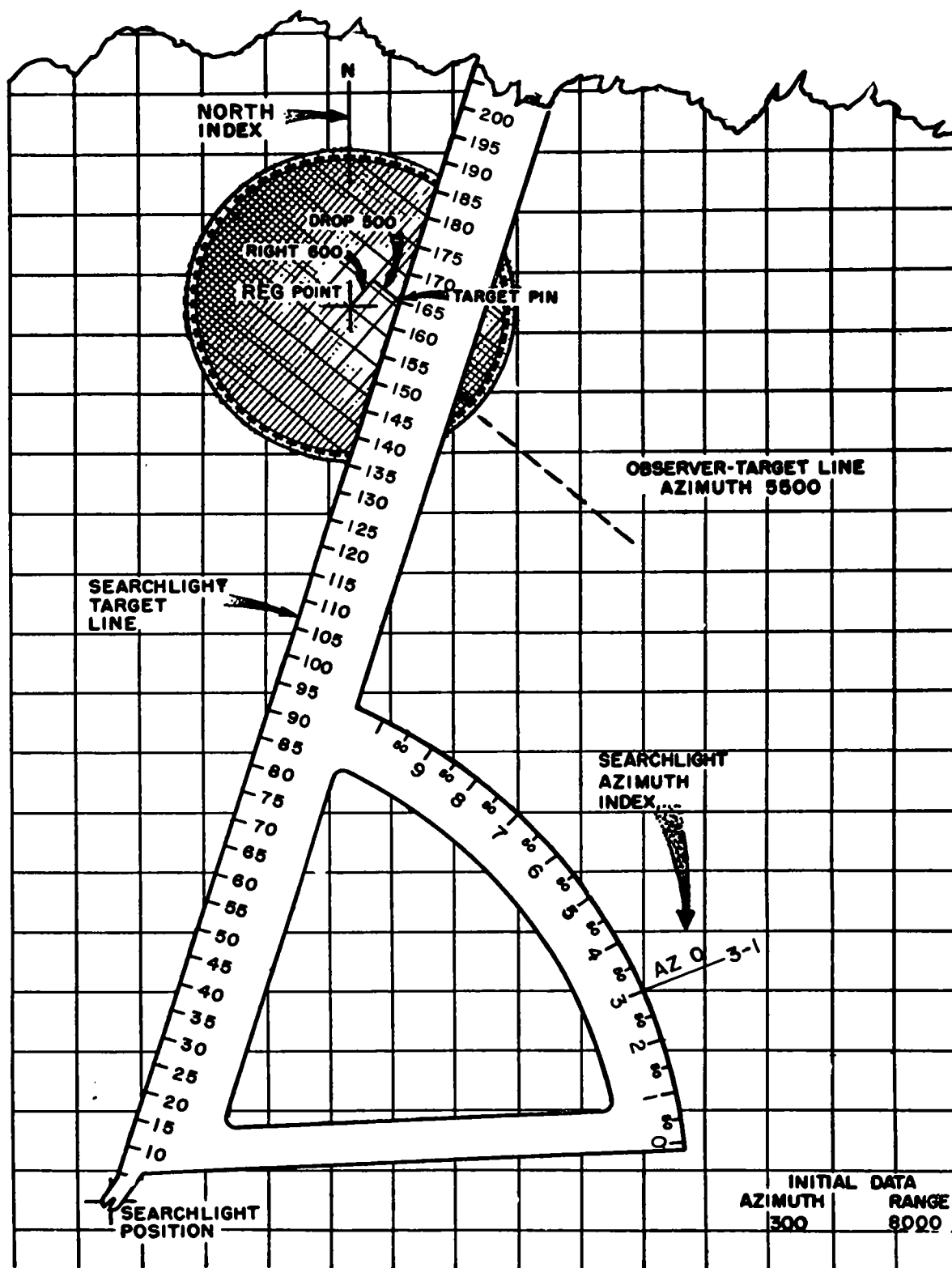


Figure 16. Light direction chart operations.

the known point when no shift up or down is made. Altitude is expressed in meters. The chart operator announces the altitude immediately after the azimuth and range. The altitude is always preceded by the word ALTITUDE and followed by the unit of measure; for example, NUMBER 3, AZIMUTH 300, RANGE 8000, ALTITUDE 155 METERS.

79. Duties of the Computer

a. General. The computer is also a key member of the light direction center. He must accurately and rapidly convert the light direction officer's illumination order, the chart data, and the observers' corrections into commands and transmit the commands to the searchlights. The computer should be trained to perform the duties of the chart operator.

b. Alerts the Searchlights. The computer alerts the searchlight(s) as soon as the mission is received. Commands are sent as rapidly as they are determined; it is not necessary to send all elements of a command in one transmission. The computer repeats all data received from the light direction officer and the chart operator and records the data in the computer's record.

c. Records LDC Data. The computer records the—

- (1) Illumination missions reported to the light direction officer.
- (2) Light direction officer's illumination order.
- (3) Chart operator's data.
- (4) Computations and commands.
- (5) Searchlight section chief's reports, to include orienting data, minimum elevations for each searchlight in its primary zone of responsibility, and time of recarboning.

d. Computes Elevation for Direct Illumination. By using the data announced by the chart operator, the computer determines the difference in altitude (vertical interval), in meters, between the searchlight and the target. Using the computed vertical interval (to the nearest 10 meters) and the announced range (to the nearest 100 meters) to the target as arguments, the computer reads the elevation directly from a previously computed table. Table I is an example of such a table. If there is no table available, the computer can determine the elevation by using the military slide rule, as follows: divide the vertical interval (in meters) by the searchlight-target range (in thousands of meters). The answer,

read to the nearest whole mil, is the elevation necessary to illuminate the target.

e. Computes Elevation for Diffused Illumination. When diffused illumination is used, the searchlight elevation must be sufficient to allow the beam to clear any masks between the searchlight and the target. By using the data announced by the chart operator, the computer determines the elevation to be used by adding the value, in mils, of one-half beam width to the minimum elevation for each searchlight.

f. Computes Elevation for Reflected Illumination. Using the data announced by the chart operator, the computer determines the elevation necessary to illuminate a target by reflection. Table II indicates the angle of elevation required to illuminate targets at fixed distances computed for certain cloud base heights. Figure 17 shows a means of obtaining cloud base height. Normally, the platoon commander will direct the assistant platoon commander or the searchlight section chief to measure and compute the cloud base height. This should be done prior to an indirect illumination mission. The clinometer on the M2 compass, or an aiming circle is used to measure the angle A shown in the figure. Angle A will be an approximation since irregularities in cloud formation will diffuse the beam over a considerable area. This diffusion will prevent the observer from perceiving the exact point at which the light beam strikes the cloud coverage. However, the cloud base height computed by this method will be sufficiently accurate to illuminate an area prior to final adjustment.

g. Announces Commands. After the computer has recorded the observer's initial illumination request and the light direction officer's illumination order and data, he announces the commands to the searchlights in the sequence given in the computer's record (fig 18).

Element	Source	Example
The searchlight(s) illuminating.	LDO illumination order.	MOON BEAM 6, ILLUMINATION MISSION.
Beam spread.....	LDO illumination order.	FOCUSED.
Control.....	LDO illumination order.	WHEN READY.
Azimuth.....	Announced by the chart operator.	AZIMUTH 5850.
Elevation.....	Determined by the computer.	ELEVATION 30.

Table I. Elevations for Direct Illumination

Range (hundreds of meters)																														
Vertical interval	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105	110	115	120	125	130	135	140	145	150
100	204	102	68	51	41	34	29	25	23	20	19	17	16	15	14	13	12	11	11	10	10	9	9	8	8	8	8	7	7	7
90	184	92	61	46	37	31	26	23	20	18	17	15	14	13	12	12	11	10	10	9	9	8	8	8	7	7	7	7	6	6
80	163	82	55	41	33	27	23	20	18	16	15	14	13	12	11	10	10	9	9	8	8	7	7	7	7	6	6	6	6	5
70	143	72	48	36	29	24	20	18	16	14	13	12	11	10	10	9	8	8	8	7	7	7	6	6	6	6	5	5	5	5
60	122	61	41	31	24	20	18	15	14	12	11	10	9	9	8	8	7	7	6	6	6	6	5	5	5	5	4	4	4	4
50	102	51	34	25	20	17	15	13	11	10	9	9	8	7	7	6	6	6	5	5	5	5	4	4	4	4	4	4	4	3
40	82	41	27	20	16	14	12	10	9	8	7	7	6	6	5	5	5	5	4	4	4	4	4	3	3	3	3	3	3	3
30	61	31	20	15	12	10	9	8	7	6	6	5	5	4	4	4	4	3	3	3	3	3	3	2	2	2	2	2	2	2
20	41	10	14	10	8	7	6	5	5	4	4	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	1	1	1
10	20	10	7	5	4	3	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Note. To compute elevation for vertical intervals (VI) greater than 100 meters, compute elevation in 100-meter VI increments, and then add as many 10-meter VI increments as necessary. Vertical interval and range factor are given in meters.

Table II. Table of Angles of Elevation in Mils for Illumination by Reflection of Light Beams From Cloud Base

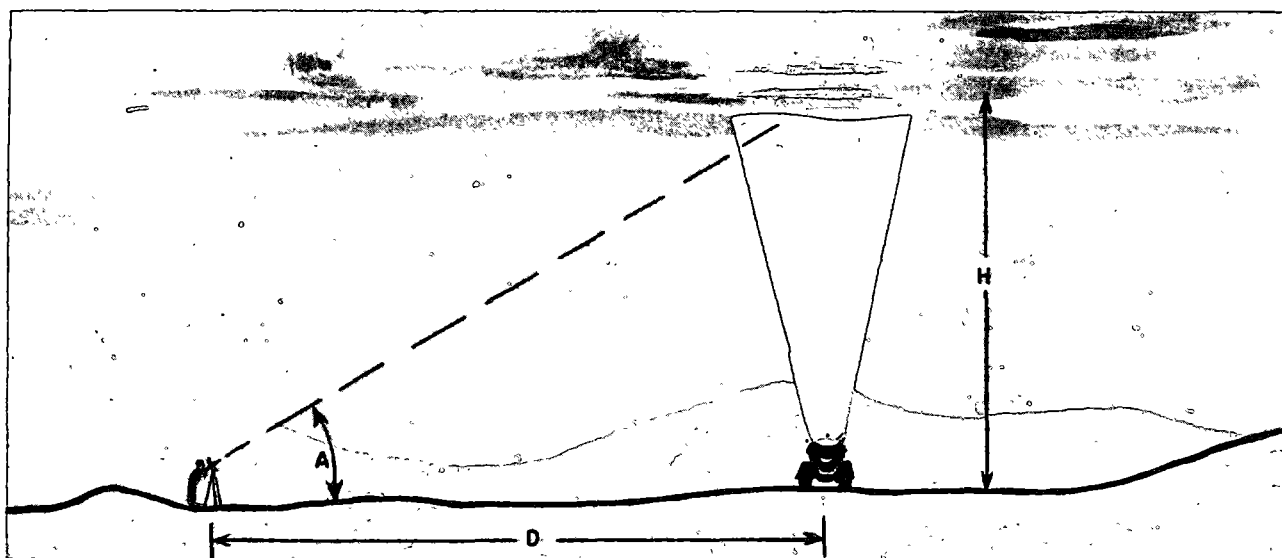
Height of cloud base above searchlight Meters	Range from searchlight position to center of target area in thousands of meters														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
100	100	50	35	25	20	15	15	15	10	10	10	10	10	5	5
200	200	100	70	50	40	35	30	25	25	20	20	15	15	15	15
300	295	150	100	75	60	50	45	40	35	30	30	25	25	20	20
400	390	200	135	100	80	70	60	50	45	40	35	35	30	30	25
500	470	250	170	125	100	85	70	65	55	50	45	40	40	35	35
600	550	300	200	150	120	100	85	75	70	60	55	50	45	45	40
700	620	345	235	175	140	120	100	90	80	70	65	60	55	50	45
800	685	385	265	200	165	135	110	100	90	80	75	70	65	60	55
900	745	430	295	230	180	150	130	115	100	90	85	75	70	65	60
1000	800	470	325	250	200	170	145	125	110	100	90	85	80	70	70

Note. 1. The values indicated are to the nearest 5 mils.

2. Cloud coverage of 60 percent or greater at reasonably uniform height over target area should exist.

3. For conditions appearing below heavy line on table, better results probably will be obtained from illumination by diffusion rather than illumination by reflection.

4. Cloud base height within 150-900 meters is desired.



FOR A LESS THAN 300 MILS: $H = A \text{ (IN MILS)} \times D \text{ (IN THOUSANDS)}$

FOR A GREATER THAN 300 MILS: $H = D \text{ (IN THOUSANDS)} \times \tan A \text{ (IN MILS)}$

Figure 17. Method of determining height of cloud base.

Section IV. EXAMPLES OF ILLUMINATION MISSIONS

80. Example 1: Light Direction Center Procedure

(fig. 18)

a. General Information.

Unit: 30-inch searchlight platoon with six searchlights.

Mission: Direct support of the 1st Infantry Division.

Positions: Two searchlights in forward slope positions suitable for direct illumination; the four remaining searchlights are on reverse slope positions suitable for indirect illumination.

b. Procedure.

Observer reports:	THIS IS NOBLE DELTA 44, ILLUMINATION MISSION, FROM REGISTRATION POINT, AZIMUTH 4800, RIGHT 400, DOWN 10, DROP 600, SUSPECTED PATROL, WILL ADJUST.
LDO announces:	NUMBER 3, DIRECT, FOCUSED BEAM, WHEN READY, CONCENTRATION A101L.
LDO to observer:	NUMBER 3, DIRECT, CONCENTRATION A101L.
Chart operator announces:	NUMBER 3, AZIMUTH 5180, RANGE 4000, ALTITUDE 335 METERS.
Commands by computer:	MOON BEAM 3, LIGHT MISSION, FOCUSED BEAM, WHEN READY, AZIMUTH 5180, ELEVATION MINUS 10.

<i>Observer's corrections</i>	<i>Commands by computer</i>
LEFT 2 BEAMS, DOWN 1/2-BEAM.	AZIMUTH 5080, ELEVATION MINUS 40.

*Observer's corrections**Commands by computer*

HOLD.....	HOLD.
END OF MISSION, PATROL NEUTRALIZED.	CUT, END OF MISSION, PATROL NEUTRALIZED.

81. Example 2: Light Direction Center Procedure

a. General information. The general information for example 2 is the same as for example 1.

b. Procedure.

Observer reports:	THIS IS NOBLE DELTA 44, ILLUMINATION MISSION, COORDINATES 246357 AZIMUTH 4210, PATROL ACTIVITY IN AREA, INDIRECT, WILL ADJUST.
LDO announces:	NUMBER 2, INDIRECT, FOCUSED BEAM, WHEN READY, CONCENTRATION A102L.
LDO to observer:	NUMBER 2, INDIRECT, CONCENTRATION A102L.
Chart operator announces:	NUMBER 2, AZIMUTH 3590, RANGE 5000, ALTITUDE 335 METERS.
Commands by computer:	MOON BEAM 6, LIGHT MISSION, FOCUSED BEAM, WHEN READY, AZIMUTH 3590, ELEVATION PLUS 20.

<i>Observer's corrections</i>	<i>Commands by computer</i>
LEFT 100.....	AZIMUTH 3570, ELEVATION PLUS 20.
HOLD.....	HOLD.
END OF MISSION, PATROL NEUTRALIZED.	CUT, END OF MISSION, PATROL NEUTRALIZED.

COMPUTER'S RECORD-SEARCHLIGHT (FM-6-115)						
ILLUMINATION MISSION <i>FROM R P, A24800 R400, D10,-600 SUSPECTED PATROL WILL ADJUST</i>			ALTITUDE OF SEARCHLIGHT <i>375</i>		ILLUMINATION MISSION <i>No. 3</i>	
			ALTITUDE OF TARGET <i>335</i>		SPREAD <i>FOCUSED BEAM</i>	
			DIFFERENCE (<i>±</i>) <i>40</i>		CONTROL <i>WHEN READY</i>	
			RANGE <i>4000</i>		AZIMUTH <i>5180</i>	
LDO ORDER <i>No. 3, DIRECT, FOCUSED BEAM, WHEN READY CONC A101L</i>			ELEVATION (<i>±</i>) <i>10</i>		ELEVATION (<i>±</i>) <i>10</i>	
			TIME ILLUMINATION BEGUN <i>2205</i>		TIME ILLUMINATION COM- PLETED <i>2220</i>	
CORRECTIONS			SUBSEQUENT COMMANDS			
BEAM SPREAD	DEVIATION	ALTITUDE	BEAM SPREAD	CONTROL	AZIMUTH	ELEVATION
	<i>L2 BEAMS</i>	<i>D½ BEAM</i>			<i>5080</i>	<i>-40</i>
	<i>HOLD</i>			<i>HOLD</i>		
<i>END OF</i>	<i>MISSION,</i>	<i>PATROL</i>	<i>CUT,</i>	<i>END OF</i>	<i>MISSION,</i>	<i>PATROL</i>
	<i>NEUTRALIZED</i>			<i>NEUTRALIZED</i>		
ADJUSTED DATA			<i>FOCUSED BEAM</i>		<i>5140</i>	<i>-20</i>
RECARBONING DATA				DATE <i>20 AUG</i>		
MINUTES OPERATION REMAINING SINCE RECARBONING (CARRIED FOWARD)				COMPUTER <i>J. DOE</i>		
MINUTES OPERATION THIS MISSION				SEARCHLIGHT <i>No. 3</i>		
NET MINUTES OPERATION REMAINING UNTIL RECARBONING				CONC NUMBER <i>A101L</i>		

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Figure 18. Example of a completed computer's record.



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CHAPTER 10

MAINTENANCE, DECONTAMINATION AND DESTRUCTION OF EQUIPMENT, INSPECTIONS, AND TRAINING

Section I. MAINTENANCE

82. General

Maintenance is essential to insure that the section is prepared to carry out its mission immediately. Systematic maintenance provides the best insurance against unexpected breakdown at the critical moment when maximum performance is essential.

83. Disassembly, Adjustment, and Assembly

Authorized disassemblies and adjustments of the searchlight and engine generator authorized to be performed by battery personnel are prescribed in

technical manuals pertaining to the equipment. Deviation from these prescribed procedures is not authorized, except as authorized by the responsible maintenance offices.

84. Maintenance

Detailed instructions for maintaining the 30-inch searchlight and engine generator and the 1/4- and 3/4-ton trucks are contained in the appropriate technical manuals and lubrication orders. Equipment records will be maintained in accordance with TM 38-750.

Section II. DECONTAMINATION OF EQUIPMENT

85. General

Equipment that has been contaminated by chemical or biological agents or radioactive material constitutes a danger to personnel. Decontamination is accomplished by removing, neutralizing, destroying, or covering toxic agents or radioactive material (TM 3-220). In most cases, decontamination only reduces the hazard from CBR contamination to an acceptable level. Periodic checks must be made to insure that the hazard does not return. The first priority of decontamination is personnel. Those pieces of equipment and the areas that are needed for the accomplishment of the mission must then be decontaminated.

86. Decontamination Principles

a. In all decontamination operations, the soldier must exercise care to avoid contaminating himself. After clothing or equipment has been decontaminated, the adequacy of the decontamination should be tested to avoid later hazard. Equipment which has been contaminated with a chemical agent should be periodically rechecked for adequacy of decontamination; such equipment should be marked as having been contaminated. When heated, chemical agents which have been absorbed by the equipment may produce a vapor hazard.

b. For detailed information on decontamination, see FM 21-40 and TM 3-220.

Section III. DESTRUCTION OF EQUIPMENT

87. General

a. The destruction of the searchlight and associated equipment subject to capture or abandonment in the combat zone will be undertaken by the using unit only when, in the judgment of the unit commander concerned, such action is necessary in accordance with the order of, or the policy established by, the Army commander.

b. The information given in paragraph 88 is for guidance only. Some of the procedures require the use of explosives and incendiary grenades which may not be authorized items of issue for the using unit. The issue of these items and related materials and the conditions under which destruction will be effected must be a matter of command decision, based on the tactical situation in each case.

88. Methods of Destruction

a. All personnel of the unit must know the plan and priority of destruction of equipment. The methods of destruction are as follows:

- (1) To destroy the searchlight, use an axe or sledge to completely smash and destroy all electrical equipment, the control box, azimuth and elevation controls and scales, cables and cable receptacles and hydraulic equipment. Break the glass and throw a hand grenade into the drum. If grenades or other explosives are not available, use an ax or sledge or a concentrated burst of machinegun fire to gain the same effect. Make certain that the mirror is thoroughly distorted and perforated and that the burner plate assembly is completely destroyed.
- (2) To destroy the engine-generator, use an axe or sledge to completely smash and destroy the control panel, spark plugs, distributor, and electrical cables. Place an incendiary grenade on the engine block.

Unlatch the commutator cover from the generator and drop an incendiary grenade into the aperture.

b. When equipment must be destroyed to prevent its use by the enemy, the searchlight and associated equipment must be so damaged that they cannot be restored to a usable condition in the combat zone by either repair or cannibalization. However, when lack of time and personnel prevents destruction of components, priority will be given to the destruction of those components most difficult to replace. It is equally important that the same essential parts on all equipment must be destroyed so that the enemy cannot salvage a complete searchlight or engine-generator from undamaged parts.

c. When destruction of equipment is directed, consideration should be given to—

- (1) Destruction in such a manner as to cause the greatest obstruction to enemy movement and to prevent hazard to friendly troops from fragments when explosives are used.
- (2) Appropriate safety precautions.

Section IV. INSPECTIONS

89. Inspections

Regular inspections are required to insure that materiel is maintained in serviceable condition.

a. The chief of section is responsible for the equipment within the section. He should inspect the equipment thoroughly each day and take immediate action to correct any deficiencies found.

b. The platoon commander, accompanied by the searchlight electrician, should make a daily spot check inspection on different parts of the materiel each day to insure complete coverage every few days. He should also make frequent mechanical inspections of the searchlight, engine-generator, truck, auxiliary equipment, tools, and spare parts.

c. Battery and higher commanders should make frequent command inspections to assure that the equipment in their commands is being maintained at prescribed standards of appearance, condition, and completeness.

d. Duties of individuals in performing the necessary maintenance of the searchlight, power generator, and trucks are outlined in paragraphs 90 through 93. Work will be routine, thorough, and rapid if the procedures outlined in these paragraphs are followed. When the section is reduced in

strength, the chief of section must reassign duties to insure that all maintenance is completed.

e. For details on inspecting the 30-inch searchlight, power generator, trucks, and associated section equipment, see appropriate technical manuals.

90. Duties in Inspection Before Operation (March)

The inspection performed before operation is a final check on materiel before departure for training in the field, before leaving the bivouac area for combat, or before displacement. After inspection and after all deficiencies have been corrected, the trucks, searchlight, power generator, and auxiliary equipment are ready to go into action. Individual duties of personnel are listed in table III.

91. Duties in Inspection During Operation (March)

The inspections performed during operation are constant checks on the functioning of the trucks and the security of all stowed equipment. The responsibilities and duties of section personnel are as follows:

a. The chief of section supervises march discipline. He assists the driver of the lead vehicle in detecting

obstacles that could cause injury to personnel or damage to the trucks. He also periodically inspects the security of the pintle on the 1/4-ton truck and the lunette and safety chains on the searchlight trailer.

b. One of the searchlight operators operates the 1/4-ton truck prime mover for the searchlight and inspects all instruments and controls. The other crewman assists the power generator operator by performing the duties of an assistant driver for the 3/4-ton truck prime mover.

c. The power generator operator operates the 3/4-ton truck and inspects all instruments and controls.

92. Duties in Inspection During Halt

Inspections are made at the halt to insure that the trucks, searchlight, engine-generator and asso-

ciated equipment are in satisfactory operating condition. The halt provides the section an opportunity to inspect for malfunctions that could not be detected during operation. The inspection duties of the members are listed in table III.

93. Duties in Maintenance After Operation

Immediately after operation, the trucks, searchlight, and power generator are given whatever maintenance is needed to prepare them for further sustained action or to determine the need for additional maintenance by higher echelons. These operations may be performed in a training area, a bivouac area, or a combat position. Individual duties of searchlight section personnel are listed in table III.

Section V. TRAINING

94. Section Drill

Duties of the chief of section and section personnel in service of the searchlight are contained in appendix II.

95. Duties in Action

Duties of the chief of section and searchlight

crewmembers in action are contained in appendix III.

96. Training Administration

The requirements for the training of searchlight battery personnel are contained in ATP 6-558, and in appendix IV.

Table III. Inspection Duties

Sequence	Chief of section	Number 1 Searchlight crewman	Number 2 Searchlight crewman	Number 3 Power generator operator
BEFORE OPERATION (MARCH) (B) AND DURING THE HALT (D)				
1	Supervises inspections by members of searchlight section in all sequences.	(B) Verifies presence, condition, and security of control box.	(B) Verifies presence, condition and security of searchlight carbon supply.	(B) (D) Performs inspection duties as prescribed by the appropriate technical manual.
2			(B) (D) Checks security of travel locking bars.	(B) (D) Checks security of cable, reel, and plugs.
3	(B) (D) Verifies that the searchlight is properly secured in traveling position.	(B) (D) Verifies that jacks are fully raised.	(B) Verifies that the azimuth and elevation brakes are on.	
4	Verifies presence of technical manuals and lubrication orders for searchlight, power generator, and vehicle; trip ticket; driver's license; and accident report forms.	(B) Verifies that carbons are removed from lamp and that the arc viewing port is covered.	(B) (D) Checks security of locking pins.	(B) Performs inspection duties on power generator as prescribed by the appropriate technical manual.
5			(B) (D) Checks security of the canvas cover.	

Table III—Continued.

Sequence	Chief of section	Number 1 Searchlight crewman	Number 2 Searchlight crewman	Number 3 Power generator operator
BEFORE OPERATION (MARCH) (B) AND DURING THE HALT (D)—Continued				
6	Reports to platoon commander, "Sir, No. (so-and-so) in order," or reports any defects which the section cannot remedy without delay.	Reports, "Number 1 ready."	Reports, "Number 2 ready." (B) (D) Performs inspection duties on vehicle as prescribed by the appropriate technical manual.	Reports, "Number 3 ready."
AFTER OPERATION				
1	Supervises inspection by all members of the searchlight section in all sequences.	Cleans outside surface of searchlight to include arc viewing port and filter.	Cleans drum interior.	Performs inspection duties on vehicle as prescribed by the appropriate technical manual.
2		Examines all exposed insulations for evidence of oil, grease, dirt, and moisture. Cleans if necessary.	Cleans and examines mirror.	
3		Examines machined parts and castings for evidence of rust. Cleans and lubricates if necessary.	Examines, cleans, and lubricates lamp, as prescribed by the appropriate technical manual.	Performs inspection duties on power generator as prescribed by the appropriate technical manual.
4		Examines jacks for evidence of dirt. Cleans if necessary.	Cleans searchlight lens.	
5		Clean and lubricate remainder of searchlight as directed by chief of section.		
6	Reports to platoon commander, "Sir, Number (so-and-so) in order," or reports any defects which the section cannot remedy without delay.	Reports, "Searchlight ready," or reports any defects or malfunctions found.	Stores cleaning and preserving materials. Performs inspection duties on vehicles as prescribed by the appropriate technical manual.	Reports, "Power generator ready," or reports any defects or malfunctions found.

APPENDIX I

REFERENCES

AR 220-58	Organization and Training for Chemical, Biological, and Radiological Operations.
AR 320-5	Dictionary of United States Army Terms (Short Title: AD).
AR 320-50	Authorized Abbreviations and Brevity Codes.
AR 385-10	Army Safety Program.
AR 611-201	Manual of Enlisted Military Occupational Specialties.
AR 750-5	Organization, Policies, and Responsibilities for Maintenance Operation.
DA Pam 310-series	Military Publications (as applicable).
ATP 6-558	Field Artillery Searchlight Battery.
TOE 6-558E	Field Artillery Searchlight Battery.
FM 5-15	Field Fortifications.
FM 5-20	Camouflage, Basic Principles and Field Camouflage.
FM 5-25	Explosives and Demolitions.
FM 6-2	Artillery Survey.
FM 6-10	Field Artillery Communications.
FM 6-20-1	Field Artillery Tactics.
FM 6-20-2	Field Artillery Techniques.
FM 6-40	Field Artillery Cannon Gunnery.
FM 6-121	Field Artillery Target Acquisition.
FM 6-140	Field Artillery Cannon Battalions and Batteries.
FM 7-24	Communication in Infantry and Airborne Divisions.
FM 17-70	Communication for Armored Units.
FM 20-60	Battlefield Illumination.
FM 21-5	Military Training Management.
FM 21-6	Techniques of Military Instruction.
FM 21-30	Military Symbols.
FM 21-40	Small Unit Procedures in Chemical, Biological, and Radiological (CBR) Operations.
FM 21-41	Soldier's Handbook for Chemical and Biological Operations and Nuclear Warfare.
FM 21-48	Chemical, Biological and Radiological (CBR) and Nuclear Defense Training Exercises.
FM 21-60	Visual Signals.
FM 22-5	Drills and Ceremonies.
FM 24-1	Tactical Communications Doctrine.
FM 24-18	Field Radio Techniques.
FM 24-20	Field Wire and Field Cable Techniques.
FM 31-16	Counter guerrilla Operations.
FM 31-22	U.S. Army Counterinsurgency Forces.
FM 31-73	Advisor Book for Counterinsurgency.
FM 61-100	The Division.

FM 100-20	Field Service Regulations Counterinsurgency.
FM 101-10-1	Organizational, Technical and Logistical Data Part I.
TM 3-220	Chemical, Biological, and Radiological (CBR) Decontamination.
TM 6-300	Army Ephemeris (as applicable).
TM 9-1900	Ammunition, General.
TM 21-300	Driver Selection and Training (Wheel Vehicles).
TM 21-305	Manual for the Wheeled Vehicle Driver.
TM 38-750	Army Equipment Records Procedures.
STANAG No. 2088	Battlefield Illumination.

APPENDIX II

SECTION DRILL

Section I. GENERAL

1. Objective

The objective of section drill is the attainment of efficiency—maximum precision coupled with high speed.

2. Instructions

a. Adherence to drills prescribed in this manual is necessary to develop maximum efficiency and to prevent injuries to personnel and damage to equipment. Section drill should be conducted in silence except for commands and reports. The section

must be drilled until reactions to commands are automatic, rapid, and efficient. Mistakes are corrected immediately.

b. Duties should be rotated during training so that each member of the section can perform all the duties within the section. In addition, battery personnel not assigned specific duties during drill periods should be trained in the fundamentals of section drill in order that they will be capable of functioning efficiently with a searchlight section, if required.

Section II. PRELIMINARY COMMANDS AND FORMATIONS

3. To Form the Section

a. *To Fall In.* The chief of section takes his post. On the command of execution, the section forms in a single rank centered on and facing the chief of section at a distance of 3 paces. The chief of section may indicate in his preparatory command the place and direction in which the section is to form. The command is FALL IN or IN REAR OF THE LIGHT, FALL IN. Execution is as follows: The section moves at double time and forms at normal interval, at attention, with Number 1 on the right, Number 2 in the middle, and Number 3 on the left. The section guides on Number 1.

b. *To Call Off.* The section being in formation, the command is CALL OFF. At the command, all personnel in ranks except Number 1, execute eyes right. The section then calls off in sequence, 1, 2, 3. As each man calls out his designation, he turns his head smartly to the front.

4. To Post the Section

The command is SECTION, POSTS. The command is general and is applicable whether the section is in or out of ranks, at a halt, or marching. All movements are executed at double time and are terminated at a position of attention.

5. To Change Posts

Posts of the section personnel should be changed frequently so that all members of the section will be trained in all duties. The section being in formation, the command to change posts is CHANGE POSTS, MARCH. At the command MARCH, Number 3 moves at double time in rear of the section to the post of Number 1 and all other numbered crewmen take two left steps.

6. To Fall Out

a. *During Drill.* When it is desired to give the personnel a rest from drill or to relieve them temporarily from a formation or post, the command FALL OUT is given. The command may be given at any time and means that the section is to remain in the vicinity of the drill area.

b. *When Searchlight is in Action.* When action has been suspended temporarily, but it is desired to have the section remain in the vicinity of the searchlight, the command FALL OUT is given. Men stand clear of the searchlight to insure that settings and laying remain undisturbed. During these periods, the chief of section may direct the men to improve the position or to do other necessary work.

Section III. PREPARE FOR ACTION AND MARCH ORDER

7. General

The searchlights of a battery will be emplaced individually under the direction of the chiefs of sections. Preparation of the position prior to occupation is governed by the time available and the unit SOP. To facilitate the occupation, a stake should be driven into the ground at a point where the center of each searchlight is to be placed.

8. To Prepare For Action

a. The searchlight being in position or approaching the position, the command to prepare it for action is PREPARE FOR ACTION. Duties of individuals

are given in table IV. Each man takes his post upon completion of his duties.

b. If PREPARE FOR ACTION has not been ordered before the searchlight is established in position, the command is habitually given by the chief of section as soon as the section vehicles are halted in position. If the searchlight is not to be prepared for action, a supplementary command, "Do not prepare for action" must be given.

9. March Order

To prepare to resume travel, the command is MARCH ORDER. Duties of individuals are given in table V. Each man takes his post upon completion of his duties.

Table IV. Duties in Prepare for Action

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (power generator operator)
1	Commands PREPARE FOR ACTION. Supervises the work of all members of the section throughout all sequences.	Set hand brake.	Disconnects the safety chains and the intervehicular cable.	Removes canvas covers from the power generator.
2		Lower the parking stand.		Checks the power generator engine oil.
3		Opens the pintle on the towing vehicle.	Removes the towing vehicle from the trailer.	Extends the power cables (female end) from the reel to the searchlight (do not connect).
4		Removes the canvas cover from the searchlight.	Assists Number 1	Connects the power cables (male end) to the receptacles on the generator.
5		Removes the lockpin and lowers the front jack; reinsert lockpin.	Removes the lockpin and lowers the right and left rear jacks; reinserts the lockpin.	
6			Raises or lowers the parking stand until the coupling eyebolt pin can be removed.	
7		Removes the coupling eyebolt pin.	Releases the handbrake.	
8			Lifts upon the lunette and removes the trailer from the searchlight.	

Table IV—Continued.

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (power generator operator)
9		Disengages the travel spring shock from lamp drum handle, lower it, and engage with post.		
10		Releases the right housing tie-down spring.	Releases the left housing tie-down spring.	
11			Connect the power cables from the generator to the receptacles on searchlight. (Be sure that the generator is not operating when making cable connections.)	
12		Directs Number 3 to start power generator.		Starts the power generator when ordered to do so by Number 1.
13	Sights through orientation sight onto the distant aiming-point or aiming stake as previously designated. If aiming stake has not been previously placed, directs No. 3 to position the aiming stake at the orienting azimuth.	Removes the positive rod electrode support tube from its stowage clips and inserts it in the front door.		Positions stakes on orders from the chief of section.
14		Inserts the positive rod electrode.	Opens the back door and puts the negative disc electrode on the negative head, and assists Number 1 in inserting the positive head assembly.	
15			Raises the cover of the base level.	
16			Releases the azimuth brake.	
17		Rotates the lamp drum assembly until the base level is in line with the front and right rear jacks.		
18		Raises or lowers the front jack until the bubble in the base level is centered, engage the detent lock.		
19		Rotates the lamp drum assembly until the base level is in line with the left and right rear jacks.	Raises or lowers the left rear jack until the bubble in the base level is centered, engage detent lock. (Do not move the right rear jack.)	

Table IV—Continued.

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (power generator operator)
20			Releases the elevation brake.	
21		Positions the lamp drum assembly with the elevation scale reading zero.		
22		Opens the door of the drum level and checks if bubble is centered.	Locks the elevation brake.	
23		Hangs the control box on the brackets located on the right trunnion and connects the control box cable in the receptacle on the lamp drum.		
24		Directs Number 3 to turn the main circuit breaker on.		
25		Lay the searchlight on the distant aiming point or stake.		Turns the main circuit breaker on when directed to do so by Number 1.
26	Verifies that the searchlight is prepared for action. Reports to platoon leader, "Sir, Number (so-and-so) in order," or reports any defects that the section cannot remedy without delay.			

Table V. Duties in March Order

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (power generator operator)
1	Commands MARCH ORDER. Supervises the work of all members of the section throughout all sequences.	Directs No. 3 to turn main circuit breaker off.	Disconnects the power cables from the searchlight.	Turns the main circuit breaker off when told to do so by Number 1.
2	When wire contact is being broken, checks into the radio net.	Disconnects and removes control box.	Removes and stows the positive rod electrode support tube.	Turns the power generator off and closes the control panel door.
3		Elevates the lamp drum assembly to vertical position and attaches the travel spring shock.		Disconnect the power cables from the generator.

Table V—Continued.

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (power generator operator)
4		Attaches the right housing tie-down spring.	Attaches the left housing tie-down spring.	Replaces the canvas cover on the generator.
5		Raises the front of the trailer and positions it under the searchlight, engaging the upper searchlight mounting lugs in the searchlight support slots of the trailer.	Assists Number 1.	
6		Lowere the front of the trailer until the coupling eyebolt is in alinement with the eyebolt slot.	Secures the coupling eyebolt pin and the safety pin.	
7		Removes the pin and lifts the front jack to its highest position; then raises the jack with jackscrew knob to its maximum height, and engages the detent lock.	Removes the pin and lifts the right and left rear jacks to their highest positions; then raises the jacks with the jackscrew knob to their maximum height and engages the detent lock.	Reels in the power cables.
8		Replaces the canvas cover on the searchlight.	Assists Number 1.	
9		Connects the towing vehicle to the trailer.	Assists Number 1.	
10		Raises the parking stand to its maximum height.	Releases the handbrake.	
11	Verifies that the searchlight is prepared for traveling. Reports to the platoon leader, "Sir, No. (so-and-so) in order," or reports any defects that the section cannot remedy without delay.	Assists Number 3 reeling in power cables.	Assists Number 3 reeling in the power cables.	



APPENDIX III

DUTIES IN ACTION

1. Duties of Individuals

The general instructions given in paragraph 2 of appendix II on section drill apply equally to section drill in duties in action. In general, the duties of individuals in the section in action are as follows:

a. The chief of section supervises and commands the section and is responsible for insuring that all duties of the section are performed properly, that all commands are executed, and that all safety precautions are observed.

b. The searchlight crewmen (Numbers 1 and 2) operate the searchlight and lay the searchlight for direction and elevation. One of the crewmen also drives and maintains the $\frac{1}{4}$ -ton truck which tows the searchlight.

c. The power generator operator operates and maintains the power generator and drives and maintains the $\frac{3}{4}$ -ton truck which tows the generator.

2. Chief of Section

a. *Duties.* The Chief of Section—

- (1) Follows illumination commands.
- (2) Supervises the positioning of the searchlight and generator.
- (3) Measures the site to the mask when the mission is to provide indirect illumination.
- (4) Reports mistakes and unusual incidents to the platoon commander.
- (5) Conducts prearranged illumination.
- (6) Records basic data.
- (7) Observes and checks the functioning of the searchlight and generator.
- (8) Assigns duties when operating with reduced personnel.
- (9) Controls the movement of the searchlight prime movers.

b. *Detailed Description of Duties.*

- (1) *Follows illumination commands.* The chief of section will follow illumination commands. He repeats the commands as required.

- (2) *Supervises the positioning of the searchlight and generator.* The chief of section closely observes the positioning of the searchlight and generator, making certain that the searchlight is positioned so as to accomplish the illumination commands.
- (3) *Measures the site to the mask when the mission is to provide indirect illumination.* On the command MEASURE THE SITE TO THE MASK, the chief of section directs one of the searchlight crewmen to traverse while the other crewman elevates the searchlight until it is sighted at the highest point on the mask. The chief of section then verifies the laying and reads on the elevation scale the angle of site to the mask and reports to the light direction center, "Number (so-and-so), site (so much)."
- (4) *Reports mistakes and unusual incidents to the platoon commander.* If the searchlight cannot be placed into action, the chief of section promptly reports that fact and the reasons therefor to the platoon commander; for example, "Sir, Number (so-and-so) out of action, recarboning." When it is discovered that the searchlight is illuminating with a mistake in laying, the chief of section reports that fact at once; for example, "Sir, Number (so-and-so) illuminated 100 mils right." Likewise, he promptly reports other unusual incidents that affect the service of the searchlight.
- (5) *Conducts prearranged illumination.* Whenever the execution of prearranged illumination is ordered, the chief of section conducts the illumination mission in conformity with the prescribed data.
- (6) *Records basic data.* The chief of section records data of a semipermanent nature, such as minimum elevations to masks, aiming points used and their azimuths, pre-

arranged illumination, and limits of the zone of action.

- (7) *Observes and checks the functioning of the searchlight and generator.* The chief of section closely observes the functioning of the searchlight and generator during action. Before the searchlight is placed into action, he verifies the proper insertion of carbons. He promptly reports any evidence of malfunctioning to the light direction center.
- (8) *Assigns duties when operating with reduced personnel.* Whenever the number of personnel serving the searchlight is temporarily reduced below that indicated herein, the

chief of section reassigns duties to best facilitate the service of the searchlight.

- (9) *Controls the movement of the searchlight prime movers.* When it is necessary to move the searchlight and generator prime movers, the chief of section instructs the drivers as to the disposition of the vehicles. He then controls the displacement and assists the drivers through the use of hand and arm signals.

3. Searchlight Crewmen

Individual duties in action of the searchlight crewmen are listed in table VI.

Table VI. Duties of Searchlight Crewmen in Action

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (power generator operator)
1	Repeats all commands received from the light direction center.	Positions the searchlight in elevation, matching the elevation pointer with the announced reading on the elevation scale. Places the searchlight arc switch in the ON position.	Positions the searchlight in azimuth, matching the azimuth pointer with the announced reading on the azimuth scale.	Verifies that the power generator voltmeter reads from 110 volts.
2		Observes the appearance of arc through arc viewing port, verifying its normal appearance. Verifies that the positive carbon tip appears to be on the black line on the arc imaging device. Verifies that the searchlight voltmeter indicates 78 volts; if it does not, directs Number 3 to adjust the voltage. Verifies that the carbons are feeding properly and that the ammeter indicates 190 amperes.		Adjusts the power generator field rheostat as directed by Number 1.
3	Repeats subsequent commands received from the light direction center.	Repeats sequence 1 above.	Repeats the first procedure of sequence 1 above. Adjusts the beam spread on command from the chief of section.	Observes power generator instrument, hour meter, and gage readings.

Table VI—Continued.

Sequence	Chief of section	Number 1 (searchlight crewman)	Number 2 (searchlight crewman)	Number 3 (power generator operator)
4	Repeats command CUT received from the light direction center.	Places the arc switch in the OFF position.		



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APPENDIX IV TRAINING

Section I. GENERAL

1. Purpose and Scope

The purpose of this appendix is to present the absolute minimum requirements for training the personnel of a searchlight battery in the subjects contained in this manual. It includes general information on the conduct of training and a minimum training schedule.

2. Objectives

The objectives of training are to speed the attainment of proficiency by searchlight battery personnel in their individual duties and, through drill, the welding of the section into an effective coordinated unit capable of functioning effectively in combat. During training, supervisors should keep in mind the proficiency sought by ATT 6-558 for the field artillery searchlight battery.

3. Conduct of Training

a. Training will be conducted in accordance with the principles set forth in FM 21-5. The goal of training will be the attainment of the standards set forth in AR 611-201.

b. In general, individual training is conducted by noncommissioned officers as far as practicable. Officers are responsible for preparing training schedules for conducting unit training, and for supervising and testing individual training.

c. Throughout training, the application of prior instruction to current training must be emphasized.

d. A record of the training received by each individual should be kept on a progress card by each chief of section for each man in his section. This card should show each period of instruction attended, tests taken, and remarks pertaining to progress. Progress cards should be inspected fre-

quently by the platoon and battery commanders to make sure that they are being kept properly and to determine the state of training. *Requiring the chief of section to keep these records emphasizes his responsibility toward his section.*

e. The necessity for developing leadership and initiative in noncommissioned officers must be emphasized constantly throughout training.

f. The training of individuals in technical specialties should be arranged for outside of the time allotted in these schedules.

g. Administrative, supply, and maintenance personnel will receive on-the-job training in these functions under the supervision of key noncommissioned officers.

h. Subjects involving similar time-consuming preparations may be combined where practicable. For example, a reconnaissance, selection, and occupation of position may be preceded by a road march.

4. Phases

a. The training program is divided into the *section phase* and the *battery phase*.

b. For the purpose of this appendix, the term section as applied to the searchlight battery denotes an element of the battery which has specific functions found only in that type of section; for example, battery headquarters, communication section, platoon headquarters, or searchlight section.

c. The training for the searchlight sections has been combined, since training of the individual sections can be handled best under the immediate supervision of the platoon commanders.

d. Two or more sections of the battery may be combined during the *section phase* to receive training in subjects which are common to the sections.

Section II. MINIMUM TRAINING SCHEDULE

5. General

The training schedule given in paragraphs 6 through 11 below is a guide for meeting the minimum training requirements of personnel of a searchlight battery in subjects covered in this manual. Appli-

cable technical manuals provide information on which to base periods of instruction on description, characteristics, and functioning of the searchlight, vehicles, and power generators. *Additional training, beyond the scope of this schedule, is necessary to develop an efficient and well-trained section.*

6. Battery Headquarters (Section Phase)

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text references	Training aids and equipment
C-----	1	Duties of individuals-----	-----	Blackboard.
C-----	1	Command post installations-----	Para 15-17-----	Blackboard.
C-----	1	Reconnaissance, selection, and occupation of position.	Para 12-14 and 21-23-----	Blackboard and sandtable.
C-----	1	Organization of position-----	Para 26, 29a and 30.	TOE equipment.
D, PW-----	8	Field exercise in reconnaissance, selection, occupation, and organization of position.	Review previous references.	

7. Communication Personnel (Wire and Radio)

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text references	Training aids and equipment
C-----	1	Duties of individuals-----	-----	Blackboard.
C-----	3	Battery wire systems-----	Para 32 and 33-38-----	Blackboard.
C-----	2	Battery radio system-----	Para 32 and 39-42-----	Blackboard.
D, PW-----	12 (4-hour periods)	Field exercise in the installation of a battery wire and radio system.	Review previous references.	TOE equipment.

8. Platoon Headquarters (Section Phase)

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text references	Training aids and equipment
C-----	1	Duties of individuals-----	-----	Blackboard.
C-----	1	Command post installations-----	Para 15-17-----	Blackboard.
C-----	1	Reconnaissance, selection, and occupation of position.	Para 12-14 and 21-23-----	Blackboard and sandtable.
C-----	1	Organization of position-----	Para 26, 29a and 30-----	Blackboard.
D, PW-----	8 (4-hour periods)	Field exercise in reconnaissance, selection, occupation, and organization of position.	Review previous references.	TOE equipment.

9. Light Direction Center Personnel (Section Phase)

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text references	Training aids and equipment
C.....	1	Principles of light direction center operation.	Para 69-75.....	Blackboard.
C, PW.....	3	Duties of individuals.....	Para 76-79.....	Blackboard and TOE equipment.
C, PW.....	2	Light direction center procedure.....	Para 80 and 81.....	Blackboard and TOE equipment.
D, PW.....	8 (4-hour periods)	Field exercise in operation of a light direction center.	Review previous references.	TOE equipment.

10. Searchlight Sections (Section Phase)

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text references	Training aids and equipment
C.....	1	Organization of position and section.....	Para 26 and 29-31.....	Blackboard and sandtable.
C.....	1	Duties of individuals in section.....	App II.....	Blackboard.
C, D, PW.....	4	Section drill.....	App II.....	Blackboard and TOE equipment.
C, D, PW.....	4	Duties in action.....	App III.....	Blackboard and TOE equipment.
C, D, PW.....	2	Maintenance and inspections.....	Para 82-84 and 90-93.....	Blackboard and TOE equipment.
C.....	1	Decontamination and destruction of equipment.	Para 85-88 and FM 21-40, TM 3-220.	Blackboard.
D, PW.....	8 (4-hour periods)	Field exercise in operation of a searchlight section.	Review previous references.	TOE equipment.

11. Battery (Battery Phase)

C—conference; D—demonstration; PW—practical work.

Method	Hours	Subject	Text references	Training aids and equipment
C.....	1	Organization and mission of the searchlight battery.	Para 4-11.....	Blackboard.
C.....	2	Capabilities and limitations of battlefield illumination and special operations.	Para 43-56.....	Blackboard.
C, PW.....	3	Illumination planning and adjustment of illumination.	Para 57-63 and 64-68.....	Blackboard.
C.....	2	Reconnaissance, selection and occupation of position.	Para 12-25.....	Blackboard.
C.....	1	Organization of position.....	Para 26-31.....	Blackboard.
C.....	1	Communication.....	Para 32-42.....	Blackboard.
D, PW.....	4	Field exercise in reconnaissance, selection, and occupation of position.	All previous references.....	TOE equipment.
D, PW.....	8	Field exercise in reconnaissance, selection, occupation of position.	All previous references.....	TOE equipment.
D, PW.....	8	Field exercise in reconnaissance, selection, and occupation of position.	All previous references.....	TOE equipment.



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APPENDIX V

STANDARDIZATION AGREEMENT (STANAG)

1. GENERAL

Standardization Agreements (STANAGS) are international (NATO) agreements designed to facilitate inter-Allied operations. Upon ratification by the United States, a STANAG is binding upon U.S. Army Forces (entirely or with exceptions as noted). This appendix provides information of the STANAG implemented by this manual; it also lists other STANAG's which are not implemented by this manual but are of general interest to the users of this manual.

2. EXTRACT OF STANAG No. 2088, Battlefield Illumination.

Following is an EXTRACT of STANAG No. 2088 which provides information of particular interest and guidance for the Searchlight Battery.

NATO UNCLASSIFIED DETAILS OF AGREEMENT

GENERAL

1. This STANAG deals with the illumination of the battlefield by visible light and does not deal specifically with the use of infra-red or other invisible rays.

AGREEMENT

2. It is agreed that the NATO Armed Forces will—

- a. subscribe to the requirements, principles and definitions defined in paragraphs 3, 4 and 5;
- b. employ the techniques, pattern of illumination and methods of requesting and adjusting prescribed in paragraph 6;
- c. employ the procedures for preparing the Illumination Plan prescribed in paragraphs 7 and 8.

GENERAL REQUIREMENTS FOR ILLUMINATION

3. The principal requirement for battlefield illumination is to overcome the limitations imposed on friendly forces by the absence of lights. The requirements for battlefield illumination originate with those of an individual, a patrol, or a squad and may progress in increasing magnitude to the requirements for units and formations.

PRINCIPLES OF BATTLEFIELD ILLUMINATION

4. The following principles govern the use of battlefield illumination:

- a. The use of battlefield illumination is a command responsibility.
- b. Battlefield illumination in support of friendly forces should be provided wherever and whenever needed, in the intensity of illumination required, and throughout the period of time required.
- c. Battlefield illumination should, wherever possible, be provided by an independent source of illumination, so as to allow units the full use of their weapons.
- d. Illumination should be provided by the highest level practicable in order to conserve the illuminants available to lower echelons.

e. Each ground unit engaged in combat which has a specific need for illumination should have organic means, in accordance with its specific requirements for illumination, sufficient to accomplish the illumination mission or to maintain the required illumination until the illumination mission can be taken over by a higher echelon.

f. Alternative means of illumination should be provided, if available.

g. All battlefield illumination must be coordinated to prevent disclosure to the enemy of the operations of adjacent units. Coordination will normally be accomplished by the commanders having operational control of the illumination means and may necessitate restrictions being placed on the unit organic means.

h. Once artificial daylight is provided to supported troops, it should be provided without interruption until the need for illumination is satisfied. This type of illumination completely eliminates night vision and if interrupted would render supported troops incapable of seeing until night vision is restored.

i. The habitual use of battlefield illumination under any given set of circumstances (i.e., a limited attack or similar manoeuvre) may tend to reveal prematurely the intention of friendly forces. Care must, therefore, be exercised to prevent establishing a set pattern of operational procedures. Conversely the use of illumination techniques as part of deception plan may be profitable on occasion.

j. Battlefield illumination should be planned and coordinated with the use of infra-red equipment in such a way that—

- (1) no damage will be caused to the infra-red equipment by exposure to direct intense white light;
- (2) battlefield illumination will be avoided or reduced to an absolute minimum when infra-red operations are going on;
- (3) the most suitable means—battlefield illumination or infra-red light—will be used according to the situation;
- (4) a rapid change from infra-red light to battlefield illumination—or vice versa—can be performed.

BATTLEFIELD ILLUMINATION TERMS AND DEFINITIONS

5. The definitions that follow are for the purpose of this STANAG only:

a. Battlefield illumination. The lighting of the zone of action of ground combat and combat support troops by artificial means whose effect can be observed by the naked eye.

b. Close-in illumination. Illumination of an area in the immediate vicinity of individuals or units. In general, this area extends outward a distance equal to the effective range of direct fire weapons.

c. Intermediate area illumination. Illumination in the area extending in depth from the far boundary of the close-in area to the maximum effective range of the bulk of divisional artillery weapons.

d. Deep illumination. Illumination in the area extending in depth from the far boundary of the intermediate area to the maximum depth of army influence on the battlefield.

e. Artificial moonlight. Illumination of an intensity between that of approximately a one-quarter moon and a full moon on a clear night.

f. Artificial daylight. Illumination of an intensity greater than the light of a full moon on a clear night. (The optimum illumination is the equivalent of daylight.)

g. Direct illumination. Illumination provided by direct light from pyrotechnics or searchlights.

h. Indirect illumination. Illumination by diffusion or reflection, obtained by using a searchlight from defilade.

i. Illumination by diffusion. Illumination of the area beneath and to the flanks of a slightly elevated searchlight by the light scattered by atmospheric particles.

j. Illumination by reflection. Illumination of an area by reflection of a searchlight beam from low-lying clouds (150 to 900 meters above ground level).

k. Full beam spread. Searchlight beam spread to its maximum width.

l. Pencil beam. Searchlight beam reduced to, or set at, its minimum width.

m. One-half (one-quarter or one-eighth) beam spread. Searchlight beam reduced to one-half, one-quarter or one-eighth of full beam spread.

n. Illumination plan. A plan for prearranged illumination published as an appendix to the fire support plan.

o. Deflection spread. A method of firing illumination shell—each round being fired at the same range and time setting but at a different deflection (azimuth) in order to illuminate an area whose width is greater than its depth. (Dimensions are considered with respect to the Gun-Target line).

p. Range spread. A method of firing illuminations, shell—each round being fired at the same deflection (azimuth) but at a different range setting and time setting in order to illuminate an area whose depth is greater than its width. (Dimensions are considered with respect to the Gun-Target line).

q. Four-round illumination diamond. A method of firing illumination shell—a combination of deflection spread and range spread, providing illumination of a large area.

BATTLEFIELD ILLUMINATION MEANS

6. Following are the principal means of achieving battlefield illumination:

a. Ground Signals, Illuminating Grenade and Trip Flares.

* * * * *

b. Tank-Mounted Searchlights.

* * * * *

c. Artillery and Mortar Illuminating Shell.

* * * * *

d. Naval Illuminating Shell.

* * * * *

e. Searchlights.

(1) Generally, if the illumination is to be of long duration, searchlights will be used since a searchlight is capable of 90 minutes of continuous illumination.

(2) This category includes all searchlights which are not mounted on armored vehicles and which are used for illuminating the battlefield.

(3) Such searchlights are usually from 75cm to 150cm in diameter and may be mounted on trucks or trailers or transported on such vehicles but dismounted for operation. The intensity of the light is from 400 to 800 million candlepower. The searchlights are normally equipped to provide a focused pencil beam or a spread beam. For the United States 60 inch (150 cm) searchlight, the usable range of a focused beam (22 mils wide) on a clear, dark night, is about 18,300 meters.

(4) Indirect illumination is a type of battlefield illumination obtained by using the searchlight from defilade. The searchlight is employed to provide indirect illumination by diffusion or reflection. Reflected illumination has the same general characteristics as illumination by diffusion.

(5) In diffused illumination, the searchlight beam is elevated slightly above the ground. This causes the area beneath and to the flanks of the beam

to be illuminated by the light scattered by atmospheric particles. In general, best results are obtained by using a focused beam with less than 100 mils elevation.

- (6) In reflected illumination, the searchlight beam is directed against low-lying clouds (150 to 900 meters above ground level). The area illuminated receives light by reflection from the cloud as well as by diffusion. Best results are generally obtained by use of a focused beam.
- (7) Method of requesting. The request for searchlight illumination is similar to the request for artillery and mortar illuminating shell. The request should also include the type of beam which is required.
- (8) Control over the use of searchlights is exercised by the supported unit or formation commander.

f. Aircraft Flares.

* * * * *

THE ILLUMINATION PLAN

7. The illumination plan is—

- a. prepared by the Fire Support Coordination Centre and/or coordinated at the highest level affected;
- b. based upon requests of supported units of formations or as directed by higher echelon;
- c. published as an appendix to the unit or formation fire support plan.

8. Coordination is accomplished at all echelons to insure, on the one hand, integration of battlefield illumination with fire support means and, on the other, coordination of the use of all means of illumination. The illumination plan consists of the same elements and has the same format as the artillery fire plan (STANAG 2031) with the following exceptions:

- a. The artillery fire plan table becomes the illumination plan table in this instance.
- b. As the expenditure of rounds in an illumination mission largely depends upon the atmospheric conditions, the number of rounds to be expended for each mission in the illumination plan table will be replaced by the duration of the mission, given in minutes.
- c. For all illumination missions the size of the area to be illuminated, given in the target list in the column size, is expressed as the diameter of a circle. In the case of an illumination mission to be fired by an artillery unit using illumination projectiles the pattern of illumination will be given as well in the column remarks.

3. EXCEPTIONS TO STANAG No. 2088

Since ratification of this STANAG by the United States, the following exceptions are stated and should be used until they are incorporated as a revision to the STANAG by the Military Agency for Standardization:

BATTLEFIELD ILLUMINATION MEANS

6. Following are the principal means of achieving battlefield illumination:

e. Searchlights

- (1) Generally, if the illumination is to be of long duration, searchlights will be used since a searchlight is capable of continuous illumination, except for a 1-minute interruption about once each 6 hours for the purpose of changing carbons, and for about 5 minutes during each 4 hours of continuous operation for the purpose of refilling the generator tank with gasoline.

- (3) Such searchlights are * * * a spread beam. For the United States 30 inch (75cm) searchlight, the usable range of a focused beam (52 mils wide) on a clear, dark night, is about 9,100 meters.
- (5) In diffused illumination * * * by atmospheric particles. In general, best results are obtained by using a focused beam and an elevation of less than 75 mils. Optimum illumination is obtained at an elevation of 50 to 75 mils. On clear, dark nights the maximum illumination obtainable by diffusion is about equal to that of the light from a quarter moon.

4. SOLOG AGREEMENT 108

DETAILS OF AGREEMENT

The Armies of the United States, United Kingdom, Canada, and Australia agree to adopt STANAG 2088, Battlefield Illumination, including such changes and amendments and revised editions as may be agreed to without reservations by these Armies, in the ABCA Non-Materiel Program.

5. STANAG'S OF GENERAL INTEREST

The following STANAG's and SOLOG's (Standardization of Operations and Logistics) are not implemented by this manual but are of general interest to users of this manual:

- a. STANAG No. 1001 (3d Ed), Standardized System of Numbering Days and Hours Relative to a Given Operation (R) (SOLOG No. 32). To be implemented in JCS Pub 1.
- b. STANAG No. 1059, National Distinguishing Letters for Use by all NATO Armed Forces (SOLOG—Mil). To be implemented in Section V, AR 320-50.
- c. STANAG No. 2002 (Edition No. 3), Marking of Contaminated or Dangerous Land Areas.
- d. STANAG No. 2004 (2d Ed), Toxic Alarm System (U) (SOLOG No. 26). Implemented in FM 21-40.
- e. STANAG No. 2007 (2d Ed), Use of Abbreviations by the NATO Armed Forces (SOLOG No. 20). To be implemented in AR 320-50.
- f. STANAG No. 2008 (2d Ed), Standard Method of Rendering Enemy Bombing, Shelling, Mortaring, and Toxic Report.
- g. STANAG No. 2027, Marking of Military Vehicles (SOLOG No. 62). To be implemented in AR 746-2300-1.
- h. STANAG No. 2032 (2d Ed), Format for Administrative/Logistic Orders (SOLOG No. 44). To be implemented in FM 101-5.
- i. STANAG No. 2041, Operational Road Movement Orders, Tables and Graphs (SOLOG No. 17R). Implemented in FM 55-35, Motor Transport Operations and Motor Transport Units.
- j. STANAG No. 2047, Emergency Warnings of Hazard or Attack. Implemented in FM 6-140.
- k. STANAG No. 2079, Rear Area Security and Rear Area Damage Control (SOLOG No. 48R). To be implemented in FM 101-5.
- l. STANAG No. 2101, Principles and Procedures for Establishing Liaison (SOLOG No. 104).
- m. STANAG No. 2104, Friendly Nuclear Strike Warning to Armed Forces Operating on Land.



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By Order of the Secretary of the Army:

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NG: State AG (3); units same as active Army except allowance is two copies each unit.

USAR: Same as active Army except allowance is one copy each unit.

For explanation of abbreviations used, see AR 320-50.

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